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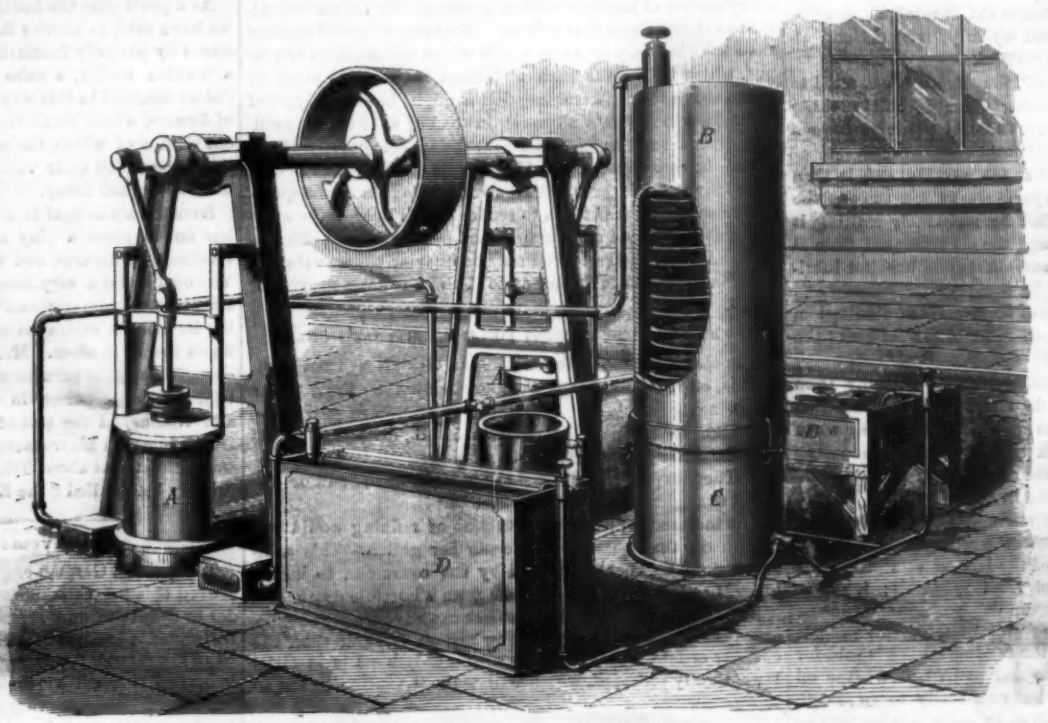
ETHER ICE MACHINE.

The improved ice making machine, illustrated in our engravings, is the invention of Mr. A. Mühl, of San Antonio, Texas, and was patented through the Scientific American Patent Agency, November 28, 1871. The apparatus is of the class in which volatile fluids, such as ether, are used for the freezing liquid, and in which the vaporized ether is again liquefied by means of condensation and pressure, and the improvements made are of a character to insure a ready, sure, and economical reduction of the vapor to a liquid state before it is allowed to reach the freezing vessels.

Fig. 1 gives a perspective view of the machine. At A are the pumps, which are connected with the driving shaft as shown. B is the condenser, which is broken away at the side in the engraving, in order to show the form of the contained worm.

The latter communicates, through the pipe seen on the outer casing of the condenser, with the reservoir, C, below. At D, E, and F, are freezing vessels of various forms. The system of pipe connections between the pumps, condenser, and freezing vessels, by which the volatile fluid is kept circulating through the machine, will be understood by inspecting the engraving. The general operation may be described in a few words. Each pump, as its piston rises, draws in from the freezing vessels the ether which has been vaporized by the heat abstracted from the water or other liquids contained in them; as its piston descends, the vapor of the ether is forced into the worm of the condenser and thence into the reservoir, C, into which it falls in a liquid state; it then passes into the freezing vessels, where it is reconverted into vapor, and from them back into the pumps. The pumps have their induction pipes provided with suction valves (see Fig. 4) and their eduction pipes with exhaust valves.



MUHL'S ETHER ICE MACHINE.

It has been customary to make the worm, which is the principal agent by which the vapor is reduced to a liquid, of a pipe of uniform cross section throughout, but this method was objectionable for the following reasons: If a small pipe was used, it was difficult to force the vapor through fast enough, and an unnecessary amount of power was consumed without effect. On the other hand, if the pipe was of the customary size—from one to two inches in diameter—only the layer of vapor immediately in contact, or nearly so, with its sides, was condensed, and the remaining uncondensed portion was discharged into the reservoir, there to be condensed at the expense of considerable power; or was, perhaps, caused to enter the freezing vessel before condensation was effected, and thereby defeat the object intended.

To obviate these difficulties the inventor uses, in this machine, a worm composed of pipes of several different sizes. Several coils of the large pipe, say of one inch and a half in diameter, are used at the point of entry, and are followed by coils of inch, half inch, and quarter inch, by the last of which the exit is made. By this means no resistance is offered to the passage of the vapor at its commencement, and all parts of its body are afterwards brought sufficiently near the sides of the pipe to insure its condensation before the reservoir is entered. Thus power is saved, and the full effect of the freezing apparatus developed.

The condenser, B, is kept full of running water while the machine is in operation, and the action of the latter is regulated and kept under complete control by the aid of various valves and stop cocks attached thereto.

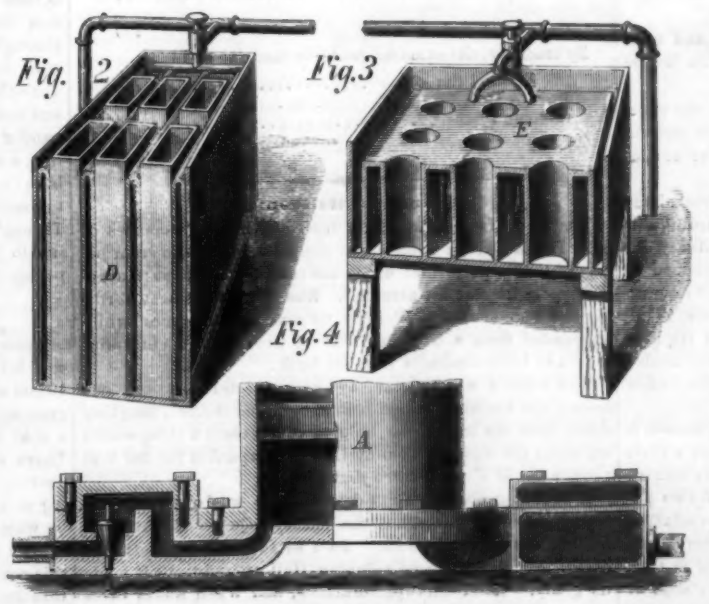
Three kinds of freezing vessels are shown in our engravings. The one at D, shown in detail in Fig. 2, contains cans, in which blocks of ice are produced. These cans stand between hollow metallic partitions, through which the freezer passes. The vessel, E, seen also in Fig. 3, is provided with receptacles for holding bottles or other small vessels, around which the other circulates. That at F is of conical form and has double walls for the passage of the ether. Within it may be placed a vessel containing the article to be frozen.

The machine has been in successful operation in Texas since 1867. Further informarion on the subject may be obtained by addressing E Fixary, P. O Box 350, New Orleans, La., or C. L. Gogin, 87 Custom House street, same city, or A. Mühl, Waco, Texas.

Separating Silver from Copper.

R. Palm prepared the nitrate of silver from small Russian coins containing a considerable percentage of copper. A rapid separation was necessary, and the utensils generally employed in effecting this separation of the two metals were wanting. Under these circumstances he restored to concentrated nitric acid, the different behavior of the two metals to the acid producing the separation.

The solution of the coin is evaporated to the consistency of a thick, oily liquid; it is then mixed with concentrated nitric acid (free from hydrochloric acid) when the silver salt will be precipitated in a crystalline form, while the copper remains in solution. The precipitate, which still has a blueish cast from adhering copper, is easily freed from it by washing it three or four times with concentrated nitric acid; it becomes then perfectly white and free from copper. The acid which still adheres to the silver salt evaporates by drying. It is absolutely necessary that the solution of the two metals is only evaporated to the oily consistency; for when we evaporate to dryness, the copper will adhere so firmly to the silver that it can only be separated from it with difficulty. The more concentrated the nitric acid, the more complete will be the precipitation; but even a specific gravity of 1·350 will answer. For every part of solution of the metals, three to four parts of nitric acid are necessary.



Flower Gardens and Pleasure Grounds.

A writer in *The American Farmer*, a first class agricultural monthly, published by Samuel Sands & Sons, Baltimore, Md., says: "Unfortunately for those who delight in rural summer retreats, and take delight in Flora's offerings, the months of July and August are meager in trees and shrubs which produce flowers at that period; this lack does not arise because the necessary articles are unattainable, but rather that attention has not been drawn to them; and to this end we will here enumerate a few, promising to enlarge the list at no very distant date. As shrubs we have, first, the *Clethora utnifolia*, whose flowers are white and fragrant; hight of bush, 4 to 6 feet. Then there is the free growing *Vitix Agnus Castus*, better known as the chaste tree, and of which there are two varieties, one of them blue and the other pale lilac, both of which should be in every collection of any pretension. *Hydrangea quercifolia* has large branches of greenish white flowers, and lobed leaves like those of an oak, and is a conspicuous and well marked article; and so is its congener *H. nivea*, with white flowers and entire leaves, which are green on the upper and snow white on the under surface, both attain a hight of 3 to 6 feet. *Buddlea Lindleyana*, which grows from 6 to 8 feet high, is a very desirable bush, and should be more planted, producing, as it does, during most of the summer months, its long pendant spikes of blue flowers which come admirably into play when making up a table bouquet; to this we would add another beauty, namely, *Ceanothus thyrsiflora*, bearing flowers like an ostrich feather, of a pale blue color. *Spiræa callosa, S. callosa alba*, the first bearing pink and the latter white flowers, deserve a place here as well as in every garden.

Belonging to the small tree kind, we recommend *Kolreuteria paniculata*, or balloon tree, as some people call it, which bears yellow blossoms on long erect spikes; and as a suitable companion to this plant *Lagerstremeria indica*, of which there are three or four varieties, one bearing pink, another purple, and a third bearing scarlet flowers we have also got the white flowering kind, but cannot vouch for the latter proving hardy; in truth, all of the varieties require protection during the winter north of Baltimore, yet there is no plant that will better repay a little care than this same *crape myrtle*. The *althea* is a very popular tree or bush, and it embraces a great many varieties, both single and double flowered; but apart from the value of the flowers, there are two or three kinds very attractive by their variegated foliage, which latter feature in floricultural productions has of late years claimed more prominence than we think it deserves. While bringing forward to the light the above desirable trees and shrubs, we would, with great respect, remember as seasonable the Virginia and Chinese trumpet flower; the first so well adapted to cover stumps of trees or old walls gone into decay, the last just the thing to plant against a summer house, or as a solitary bush on a lawn, where its robust growth will soon produce a stem strong enough to support its head erect. A new plan of growing the wisteria is to train it to a stake, six feet high, and when it reaches the top, head it off. The second year, or the third, it will support itself and form an umbrella shaped head, with hanging flowers.

In looking over files of the Melbourne (Australia) *Leader*, we observe that there is considerable activity among inventors in that distant but enterprising colony. Several patents are granted every week, and improvements are the order of the day.

HOW KEROSENE OIL IS MADE.*

The dark offensive crude petroleum is first subjected to fractional distillation. The apparatus employed consists of an iron still, connected with a coil or worm of wrought iron pipe, which is submerged in a tank of water for the purpose of cooling it. When the still has been filled with crude oil, the fire is lighted beneath it, and soon the oil begins to boil. The first products of distillation are gases; at ordinary temperatures, they pass through the soil and escape without being condensed. By cooling the coil with ice or by compressing these gases by an air pump into a strong receiver, very volatile liquors called "rhigolene" and "chymogene" are obtained.

Soon the vapors begin to condense in the worm, and a stream of oil trickles from the far end of the coil into the receiving tank. The first oils obtained have a gravity of about 95° Baumé; as the distillation proceeds, the product becomes heavier, 90° B., 85° B., 80° B., 75° B., 70° B., and so on.

In most establishments it is customary to run the product into one tank till the gravity reaches 65° B. to 59° B.; the product, known as crude naphtha, being subsequently separated by redistillation into (1) gasolene, the lightest; (2) naphtha; (3) benzine. When the stream of oil runs from the coil with a gravity from 65° to 59° B., it is diverted into the kerosene tank and continues to run into this receiver till the gravity reaches about 38° B., or until the color deepens to a yellow. This second fraction is the burning oil or kerosene, and is subsequently purified by sulphuric acid and alkali.

After taking off the burning oil, the stream is directed to the paraffin oil tanks, and continues to run there till nothing remains in the still, save coke. The last products have a gravity of about 25° B.

This oil is chilled to crystallize the paraffin, and is then folded in cloths and exposed to pressure to squeeze out the oil. The solid paraffin is purified by repeatedly melting it in naphtha, chilling, and pressing; the oil separated from it is purified with sulphuric acid and alkali, and used for lubricating purposes.

While this is a general outline of the process of distillation, it should be remarked that refiners differ in the details of the operation.

When very large stills are employed, of a capacity from one thousand to thirty-five hundred barrels, the distillation is not continued till coke is formed; but is interrupted when there remains in the still a thick tarry residuum amounting to from five to ten per cent of the original oil. This residuum is afterwards distilled to coke in smaller stills.

By slow distillation in high stills, the heavier oils are "cracked" into lighter oils, so that the refiner need not produce any heavy oil. In many of the largest establishments only three products are obtained from crude oil: 1. Crude naphtha; 2. burning oil; 3. residuum.

The burning oil is deodorized and bleached for market with sulphuric acid and alkali; the crude naphtha is sold for from 3 to 5 cents per gallon, and poured down the oil wells, nominally to clean them, but practically to be sold to the refiner again in the crude oil at 14 cents per gallon; or it is sold to be redistilled for gasolene, refined naphtha, and benzine. The well owners are many of them dishonest enough to pour the naphtha into the crude oil tank. This adulteration averages fifteen per cent. The residuum is sold to be distilled for paraffin and lubricating oil, or it is cracked in high stills, and the product put into the large stills with the crude oil. In this case no lubricating oil or paraffin are manufactured. This is the practice at Cleveland and Pittsburgh. Some redistil the last ten per cent, the colored portions of the burning oil, with the crude oil.

Some place the crude petroleum in large stills and blow steam through it, and thus take off the crude naphtha, before the oil is run into the fire still.

Some manufacturers, who pride themselves upon the superior quality of their special brands of oil, separate certain portions of the distillate, and send them to market as unusually safe oils.

The "Astral oil" is probably the oil which runs from about 54° to 44° B., in other words, the "heart" of the burning oil. As it does not contain the lighter portions of the ordinary oil, its flashing point is 125° Fah., or 25° above the standard of safety, although its average gravity is 49° B. The "mineral sperm" is a heavy oil, which probably runs between 40° B. and 32° B., averaging 36° B. This is so heavy, and requires so high a temperature to volatilize it, that it does not evolve an inflammable vapor below 263° Fah., nor take fire below 300° Fah. Practically it is as safe as whale oil.

Treatment with Acid.—After the oil has been fractioned, it is subjected to the action of sulphuric acid to remove a little color, but more particularly to sweeten it, that is, to remove the disagreeable odor which it still retains. About two per cent, by measure, of acid is poured into the oil, the mixture is thoroughly agitated, and, on standing, a dark tarry sediment separates; this is removed, and the clear oil is then agitated with water, then with alkali, either caustic soda or ammonia. This neutralizes the last traces of acid, and, after removal by water, leaves the oil "sweet." Some of the more careful refiners then subject it to a somewhat elevated temperature to expel a small percentage of naphtha or benzine which it still contains, while a few subject it to redistillation.

Why most of the kerosene in the market is unsafe.—The crude naphtha sells at from 3 to 5 cents per gallon, while the refined petroleum or kerosene sells for 20 to 25 cents. As great competition exists among the refiners, there is a strong inducement to turn the heavier portions of the naphtha into the kerosene tank, so as to get for it the price of kerosene. They change the direction of the stream from the coil of the still when it reaches 65° to 63° Fah., instead of waiting till it reaches 58°. Thus the inflammable volatile naphtha or benzine is allowed to run into the kerosene, rendering the whole highly dangerous. Dr. D. B. White, President of the Board of Health of New Orleans, found that, experimenting on an oil which flashed at 113° Fah., an addition of

One per cent of	naphtha	caused it to flash	at	....	103°	Fah.
Two	"	"	"	....	93°	"
Five	"	"	"	....	83°	"
Ten	"	"	"	....	59°	"
Twenty	"	"	"	....	40°	"

After the addition of twenty per cent of naphtha, the oil burned at 50° F.

It is, therefore, the cupidity of the refiner that leads him to run as much benzine as possible into the kerosene, regardless of the frightful consequences which result from the frequent explosions.

On every gallon of naphtha run into the kerosene tank, there is a profit to the refiner of 20 cents, or on every one per cent of naphtha added to the kerosene, a reduction of one fifth cent per gallon in the cost of production, which, with kerosene at 25 cents per gallon, amounts to 1¼ per cent. For every gallon of naphtha sold as kerosene, the refiner can afford to throw away four gallons. Nothing is more desirable than the discovery of some use to which the naphtha can be put, which will make such a demand for it as to raise its value above that of kerosene, that it might be the interest of the refiner to separate as much instead of as little as possible. It must not be supposed that the specific gravity of the oil can be considered a safe index of its quality; on the contrary, the specific gravity gives very little idea of the quality, for while naphtha tends to render the oil lighter, the average gravity of good oil is maintained by the heavier oils present. A poor, dangerous oil may be heavier than a safe oil.

Ordinary kerosene flashes at 86° Fah., but has a gravity of 47° B.

THE CHEAPEST PROCESS FOR MAKING A SAFE OIL.

The cheapest process for making an oil that will not flash, that is, emit an inflammable vapor, below 100° Fah., is the following:

1. Run off the naphtha down to 58° B., instead of 65° to 62°, the usual point.

2. Then expose the oil in shallow tanks to the sun or diffused daylight for one or two days.

The increased expense of this plan of refining would not reach more than three or four cents per gallon. This addition would be cheerfully paid by the consumer, to insure himself and his wife and children from a horrible death.

But, the refiner says, I cannot get the advanced price, because the consumer does not know my oil is safer than the cheaper article. This is true, and our only hope is in strict laws, rigidly enforced, which will make it a crime to sell an unsafe oil.

THE YIELD OF DIFFERENT PRODUCTS.

The yield of the different products from crude petroleum varies greatly in different refineries. The following is a fair average for Pennsylvania oil of about 45° B.:

Gasolene	1½
Refined naphtha	10
Benzine	4
Refined petroleum or kerosene	55
Lubricating oil	17½
Paraffin	2
Loss, gas, and coke	10
	100

By cracking, the same oil could be made to yield

Crude naphtha	20
Burning oil	66
Coke and loss	14
	100

*From a report to the New York Department of Health by Professor C. F. Chandler.

Gymnastic Balloonists.

The New Haven *Palladium* describes the performances of Miss Leona Dare, a Connecticut circus woman, who from being a humble performer under the tent has risen to remarkable experiences as an aeronaut. She has lately been thrilling the people of the West by trapeze performances while suspended from a balloon. One of these recent entertainments at Indianapolis is thus set forth:

The balloon was inflated, and at a quarter to 8 was cut loose; and the fine formed Leona, in circus clothes, dangling down from the trapeze bar, holding in her teeth a strap which encircled the waste of Tommy Hall, a companion for her first voyage in the air, left *terra firma*.

Everything was as still as death, and it was observed that Hall weakened a little, but the plucky "Queen of Antilles," Leona, was perfectly cool. Just as soon as they left the earth, Leona commenced spinning Hall around until it made us giddy. After this performance, and when about three hundred feet in the air, they commenced their highfalutin' performance, known in show language as the double trapeze.

They performed all the difficult and hazardous feats at an altitude of about half a mile, with the same reckless daring that characterizes their performances under the pavilion, where, if they were to tumble, their fall would not exceed thirty feet. Up, up they went, until they were scarcely larger than a person's hand, and, when looked at through a glass provided for the occasion, it was seen that they had climbed upon their trapeze car, and were apparently enjoying a *tête-a-tête* while resting from their exciting and perilous exercises. The balloon descended very rapidly and landed about half a mile from the starting point, in an open field, and a party rode up in time to witness their alighting. Hall was silent and sober, while Leona, laughing, said to Warner: "How was that for high?"

The Opal.

The opal comes from Hungary and Mexico. The Hungarian opals are much the superior, and have not the disadvantage of deteriorating with time. For the perfection of an opal, it should exhibit all the colors of the solar spectrum, disposed in small spaces, neither too large nor too small, and with no color predominating. The opal is sometimes called the "harlequin," in allusion to the great variety of colors which it displays. The substance of the opal is of a milky hue and of a pale greenish tint. This milkiness is generally known by the term opalescence. It is the color of water in which a little soap has been dissolved. In order to explain the brilliant colors of the opal, we may imagine in the stone a great number of isolated fissures, of variable width but always very narrow. Each fissure, according to its width, gives a peculiar tint similar to the effect produced by pressing two plates of glass together: we may recognize violet, blue, indigo, red, yellow and green, the last two being exhibited more rarely than the others.

As a proof that the brilliant colors of the opal are due, as we have said, to narrow fissures, similar colors may be produced by partially fracturing, with the blow of a hammer or a wooden mallet, a cube of glass or even a rock crystal. Colors obtained in this way are of the same character as those of flowers, which result from the overlaying of the transparent tissues of which the petals are composed. Herein lies the secret of all their varied hues from their first opening until their final decay.

Sometimes the opal is colored only in its substance, and has not so great a play of light as when it is variously traversed by fissures, and then it is not so much esteemed. The opal is not a very hard stone. In its chemical composition, it is only quartz combined with water. Heat, expanding its fissures, varies its colors, and pressure obviously produces the same effect. M. Babinet states that he thus often changed, without permanent alteration, the colors of a beautiful Hungarian harlequin opal. The opal of the Roman senator Nonius, of the size of a hazel nut, which he selected from among all his treasures as the companion of his exile, was estimated at about 800,000 dollars. This gem has appropriately been called "the Koh-i-noor of Rome."

Improvements in Blasting.

T. Klerity, a German engineer, has lately introduced an improved blasting cartridge, which is said to save much powder or dynamite, and seems to be worth notice. The new feature of it consists of a cast steel cylinder, which is inserted in the cartridge, and replaces a part of the powder, which is ignited through a touch hole in the cylinder. At both ends the cylinder is very near the calibre of the bore hole, but its middle part, for about 2-3 of the whole length, is reduced to half that diameter. This thin part has a channel bored through it at right angles to its axis, while another vertical channel follows the axis from the top until it reaches the transverse passage, both of which are filled with fine grained powder and ignited in a suitable way. The length of the steel cylinder is 12 or 14 inches, and its diameter 1 to 1½ inches at the ends, and ½ to ¾ inch in the middle. It is inserted in a cylindrical paper bag, and the powder of dynamite filled between the reduced diameter and the paper; it is then placed in the bottom of the blast, covered with a certain thickness of tamping, and fired in the usual way through the channel in the centre. Another improvement with the use of dynamite has lately been made at Raibl, in Carinthia, where the dolomitic limestone is very cavernous, and much of the power of the explosive is lost, its gases expanding uselessly into these cavities. In order to prevent this, a watertight dynamite cartridge is introduced into the bore hole, and before firing it, as much water pumped into the same as it and the next adjoining cavities would hold. Through this very simple expedient, a wonderful effect is said to have been produced, by which half of the former expenses of blasting were saved.

Coal in China.

According to Baron Richthofen and others, the Chinese coal fields cover an area of upwards of 400,000 square miles; 12,000 miles of coal have sufficed to make Great Britain the greatest workshop of the world. In the province of Hunan, a coal field extends over an area of 21,700 square miles. There are two perfectly distinct coal beds in Hunan, one bearing bituminous and the other anthracite; the latter being most conveniently situated with regard to conveyance by water, easily mined, and covering an area equal to that of the anthracite coal fields of Pennsylvania. In quality this coal will compare favorably with the best kinds of anthracite known.

The coal area of the province of Shansi is of the enormous extent of 30,000 square miles. This is capable of supplying the whole world, at its present rate of consumption, for thousands of years, and has unrivaled facilities for mining. The beds vary from twelve to thirty feet in thickness, while the system of coal bearing strata in this province is about 500 feet in thickness, and contains, besides, an inexhaustible supply of iron ore. Ping-ting-chau is conspicuous for an extraordinary and exceptionally favorable juxtaposition of coal and iron.

STRYCHNIA AND HEMLOCK.

The effects of strychnia are very simple; leaving the intellect unaffected, it chiefly seizes upon those parts of the nervous system from which flow the impulses that set the muscles in motion.

These impulses, which in the natural condition of the body result in the ordinary voluntary movements, are placed by the action of strychnia beyond the control of the will. Involuntary twitchings of the muscles and sudden jerkings of the limbs first occur; but if the dose of the poison be sufficient, these soon become general, and the body passes into a state of the most rigid spasm.

We do not observe those alternate contractions and relaxations which in a fit of ordinary convulsions—epilepsy, for example—allow of the bending and straightening of the limbs in rapid succession, but the whole of the muscles of the body are simultaneously locked by violent and continuous cramp.

From common cramp we may get some notion of the agony which racks the whole body of a person poisoned by strychnia. The effects of strychnia resemble those of tetanus (lock jaw) rather than those of epilepsy. The frightful *risus sardonicus* caused by cramp of the facial muscles, is, indeed, an expression common both to strychnia poisoning and to tetanus; and the jaws are as tightly locked in the one condition as in the other.

The rigor thus affecting the muscles of the head rapidly spreads over the whole body, which soon becomes stiffened with spasm and shaken with violent tremor; the trunk meantime is extended to the utmost, the feet are drawn into a straight line with the legs, and, at the hight of the paroxysm, the head is drawn backwards, the back is arched, and the body supported on the heels and the back of the head; the chest is fixed, and the breathing suspended. After a few seconds the cruel spasm ceases, and the muscles, which a moment before felt as hard as wood, are now flaccid and exhausted, and the suspended life returns with a long drawn sigh. Now the poor patient speaks, and in feeble, tremulous accents implores to be left undisturbed, and shudders or even passes into another paroxysm if any one approach him and attempt means for his relief.

Strychnia impresses the whole nervous system with such exquisite sensibility that the lightest touch is sufficient to evoke a fresh discharge of nervous power. Under its influence the nervous system is like an overcharged thunder cloud or Leyden jar; and disruption occurs on the faintest disturbance.

And terrible indeed are these electrical convulsions in the body. The intervals of respite and of seeming rest, but really of dread suspense, become shorter and shorter, and each succeeding discharge is more violent and prolonged. There is no gasping for breath, for the iron spasm holds the chest too rigidly confined to allow of even this niggardly relief. The interchange of gases in the blood is suspended, the air lies stagnant in the lungs, and the patient is suffocating even more rapidly than if a cord were firmly tied round his neck; the tongue grows purple, the poor heart meanwhile puts forth all its energy, and throbs almost to bursting. It avails not, however; the blood which it so hurriedly distributes wants vital air; and when the storm is over, the body falls lax into the hands of death. Then, if we look to it, we find the muscles torn by the violence of the fatal cramp.

Such are the simple effects of strychnia; and a quarter of a grain taken by the stomach, or the one sixteenth of a grain introduced under the skin, will, in a person of moderate size and strength, produce the whole of them.

And yet the mite of strychnia itself undergoes no change. We may separate the whole of it from the dead body, and therewith reproduce its effects in other living beings. Such, indeed, is the physiological test for strychnia; and it is readily applied. We take a frog fresh from the pond, and having removed the moisture, by means of a piece of blotting paper, from its back, we place thereupon a few drops of the suspected solution. It is soon absorbed, and if strychnia be present, the sensitive little animal is thrown into a state of tetanus.

Strychnia poisons all animals alike, from the tiny insect to the largest quadruped, and the hot blooded bird is as susceptible of its action as the cold blooded reptile. If a wild animal is killed by this poison, the vultures that eat the flesh are poisoned too. For several years past it has been an active instrument in the hands of the suicide and the avicide. Wheat steeped in water embittered by a minute fragment of strychnia and thrown broadcast over our fields has been, and we fear continues to be, the fatal device to which our feathered tribes fall an easy and indiscriminate prey. When will our farmers and horticulturists learn that these little laborers are worthy of their hire, and that the seed they consume is in value nothing as compared with what they save from the depredations of the fly and the canker worm?

We have spoken of strychnia merely as a poison. It is not difficult to see how, in the hands of the physician, its powerful properties may be directed to the relief of disease. As the most powerful excitant of the centers of motion, strychnia becomes the appropriate stimulant when those centers are paralysed. As a tonic it rivals quinine. Strychnia is derived from the nux vomica (*strychnos nux vomica*), a plant of the same natural order as the common blue periwinkles; but the poison abounds in many other species.

HEMLOCK.

From strychnia we pass to a consideration of its opposite, namely, hemlock. No poison claims a higher antiquity or a greater historical interest than hemlock. To the physician, there is none that surpasses it in physiological interest. The bare mention of the plant carries one back to the days of the Grecian republic, and recalls the undying names of Socrates, Theramenes, and Phocion—men who submitted to the baleful influence of hemlock rather than betray the liberty of their country. If we would learn the effects of the Athenian State poison, we may have Plato for our teacher, and for a subject him of whom Cicero justly said "that he was the first who called down philosophy from heaven to earth, and introduced her into the public walks and domestic retirements of men, that she might instruct them concerning life and manners." "Socrates," says Plato, "received the fatal cup without change of countenance or the least perturbation, and then, offering up a prayer to the gods that they would grant him a prosperous journey into the invisible world, drained it with perfect composure. His friends around him burst into tears. Socrates alone remained unmoved. He upbraided their pusillanimity, and entreated them to exercise a manly constancy worthy of the friends of virtue. His executioner directed him to walk about until he should feel his legs becoming heavy. He did so until the chilling operation of the hemlock compelled him to lie down; then it seized upon the more vital parts. The executioner approaching him, said to his friends, that when the effects of the poison should reach the heart, Socrates would depart. Then, uncovering him, he found the lower part of the body was cold. At this time Socrates spoke these his last words to his friend Crito: 'Crito, we owe Esculapius a cock; pay the debt, and do not forget it.' 'It shall be done,' replied Crito; "but consider whether you have anything else to say." Socrates answered not, but in a short time was convulsed. The man then uncovered him; his eyes were fixed; and when Crito observed this, he closed his eyelids and his mouth." In this account, we have ample proof of the action of hemlock. The legs grow heavy, and the chilling effects creep on. The victim, no longer able to stand, lies down; at last the respiration ceases, accompanied, as is usual in such cases, by a slight convulsive tremor, the mind remaining clear and tranquil to the last.

Hemlock is the exact opposite of strychnia. Strychnia excites the organs of motion; hemlock depresses them. Strychnia kills by causing intense and prolonged spasm of the muscles, by whose alternate contraction and relaxation air is drawn into and expelled from the lungs; hemlock kills by causing complete relaxation and paralysis of the muscles.

Here, then, we have two nerve poisons so completely opposed to each other that each is the antidote of the other, and a study of their action furnishes a good illustration of the principles that guide the physician in the administration of an antidote.

The Waste Products of Coal.

In the destructive distillation of coal for the production of ordinary gas, a quantity of offensively smelling water and a considerable bulk of tarry matter are also produced. These were formerly thrown away as useless and deleterious, but now they are utilized.

The noxious odor of the gas water is due to the presence of sulphur and ammonium compounds, and by simply adding sufficient quicklime the alkaline compounds are decomposed, and ammonia gas is liberated. This is conducted into chambers filled with carbonic acid gas, and thus the common salt, known as carbonate of ammonium, is produced. More than 2,000 tuns of this useful chemical are annually made from refuse gas water. If, instead of quicklime, hydrochloric acid be added, sal ammoniac is obtained, from which nearly all the medicinal preparations of ammonia are produced. The quantity of sal ammoniac thus manufactured from year to year, exceeds 4,000 tuns. If, again, sulphuric acid be employed in the place of hydrochloric acid, sulphate of ammonium is the result, about 5,000 tuns of which are annually used for manures. When to a solution of sulphate of ammonium one of sulphate of aluminum is added, the crystalline substance called alum is obtained, so generally useful in the arts. The sulphuric acid used in preparing alum may also be eliminated from gas water. The sulphur impurities referred to before are removed by means of a mixture of sawdust and iron, sulphide of iron and water being produced; air is then passed through the mixture, the effect of which is to convert the sulphide of iron back again into oxide, the sulphur at the same time separating in the form of powder. The sulphur is then burned in a properly constructed furnace, and, by causing the fumes to combine with nitrous and aqueous vapors in leaden chambers, sulphuric acid is obtained.

Let us pass now to the tarry matter, the other waste product of the distillation of coal. This is a very complex body, containing a large number of substances, most of which are volatile, some acid, some alkaline, and some neutral. By appropriate chemical means, these components of crude coal tar are obtained in a state of purity. The lighter portions, known as coal naphtha, consist principally of benzol, a liquid of great utility in the arts. By treating benzol with nitric acid, nitro-benzol is produced, which is used, on account of its sweet taste and almond-like odor, to perfume soaps and flavor confectionery. Anilin, the base of all the dyes bearing that name, is obtained from the action of nascent hydrogen on nitro-benzol. Carbolic acid is another product of the fractional distillation of coal tar. By the action of nitric acid, carbolic acid is converted into carbazotic acid, which is now used as a yellow dye. Perhaps the most interesting of all the products of coal tar is solid paraffin, a colorless crystalline fatty substance, which may truly be termed "condensed coal gas." It is found naturally in the coal measures and other bituminous strata, constituting the minerals known as fossil wax, ozokerit, etc. It exists also in solution in many kinds of petroleum, and may be obtained by distilling off the more volatile portions, and exposing the remainder to a low temperature. The greater bulk of paraffin is, however, obtained from coal tar. The oil produced from paraffin will only burn in the presence of a wick, and is therefore perfectly safe; when burning, it splits up into olefiant gas, thus producing a brilliant white light. To sum up: From the two waste products of coal, in the manufacture of gas, are obtained carbonate, chloride, and sulphate of ammonium, sulphur, and sulphuric acid, coal naphtha, benzol, nitro-benzol, anilin, carbolic and carbazotic acids, and solid paraffin.

The New Liverpool Central Station.

The Central Railway Station, now in progress at Liverpool, is owned conjointly by the Great Northern, Midland, and Manchester, Sheffield, and Lincolnshire Railways. These three great companies, for the purpose of extending their system west of Manchester, have for some considerable time formed an amalgamated committee, known as the Cheshire lines. Besides the above railway, a new and direct line between Liverpool and Manchester is being constructed under the direction of this committee. The Central Station is situated in Ranelagh street, and the front buildings are intended to occupy the whole side of the street between the Lyceum and the Adelphi Hotel. The platforms and other conveniences extend backward from Ranelagh street for the whole length of Bold street, being parallel to that fashionable lounge. Some idea of the extent of the works may be conceived from the fact that over six acres of property have been purchased for the purposes of this terminal station. The booking office and other buildings facing Ranelagh street are now nearly completed. The Italian style has been adopted in the architecture. The main building consists of three stories, and is 142 feet in length, 70 feet in width, and 60 feet in hight. The ground floor is of Tuscan order, with polished grey granite architraves. The first floor is Ionic, with polished red Aberdeen granite shafts and pilasters. The upper storey is in the Attic style, and will when completed be surmounted by a handsome clock turret. The stone chiefly used in the construction is of a fine cream colored appearance, and comes from the Ancaster quarries, in Lincolnshire. Behind the booking office the platform roof is in course of erection, with its supporting walls. Advantage has been taken of the good building stone (of the red sandstone formation) found in excavating for the works, by using it in the construction of these supporting walls. The roof over the platform, 700 feet in length, consists of one main span of 160 feet clear between supports and a side span of varying width. In the construction of this roof, for the purposes of combining strength with lightness, steel has been largely used, and this material, with a certain novelty of arrangement, will make the structure unique and one of the finest in the kingdom. In order to connect the station with the Brunswick Station at the south end of the town, and owned by the same committee, a line of a mile and a half is in course of construction. This line is chiefly in tunnel, with numerous openings for ensuring good ventilation, and passes nearly in a straight line between the two stations. The tunnel is of sufficient width for three lines of rails, and is already completed for the greater part of the distance. The line, it is expected, will be opened in the early part of the ensuing year.

How to Treat Battery Zincs.

The best rolled zinc should be employed; it gives a higher force than cast zinc, and is more economical, because cast zinc is subject to much more local action, owing to its porous condition. Cast zinc rods may be used with equal advantage in cells where they are only exposed to sulphate of zinc, or chlorides of sodium or ammonium, because these do not act by themselves on zinc.

The coating of zinc with mercury prevents the local action of the acid; it appears to effect this by giving a smooth surface, and so favoring the adhesion of hydrogen, which may be seen covering it in little bubbles; therefore, anything which tends to roughness of surface tends to increase local action and waste of zinc and acid, a point the learner should carefully fix in his memory as an axiom. The practical lesson is: keep your zincs thoroughly clean and well amalgamated. Care should be taken to use only pure mercury; much of the sold contains lead and tin, which are mischievous. The mercury should be kept for some time in a bottle, with dilute nitric acid over it, and occasionally shaken up. To amalgamate zinc, wash it first with strong soda to remove grease; then dip it in a vessel of water containing one tenth of sulphuric acid, and as soon as strong action takes place transfer it to a dish (such as a soup plate); pour mercury over it, and rub it well till a bright silver like film forms; then set it up to drain on edge, and before use, rub off any globules which are set free. Whenever the zinc shows a gray granular surface (or rather before this) brush it well and reamalgamate, remembering that saving of mercury is no economy, and free use of it no waste—for it may all be recovered with a little care. Keep a convenient sized jar or vessel solely for washing zincs in, and brush into this the dirty gray powder which forms and is an amalgam of mercury with zinc, lead, tin, etc., and forms roughnesses which reduce the protection of amalgamation. Let this powder collect for a time and then transfer it to a bottle, in which wash it with sulphuric acid first, and then with dilute nitric acid, and you will recover the mercury. This washing should be done whenever a plate is removed, and never less than once a day if in regular use; the cheap brushes are excellent for these purposes, but of course must not be left soaking with acids.

THE new rate for postal money orders, now in operation, is 5 cents for an amount not exceeding ten dollars.

SILKWORMS.

Compiled from the "Fourth Annual Report," by Charles F. Riley, State Entomologist of Missouri.]

Silk is at once the strongest and most tenacious of fibers, and makes the most beautiful, durable, and valuable of tissues. What gold is to metals, or the diamond to precious stones, that silk is to all other textile fibers.

Though we may not, at present, be able to compete, in their own markets, with the cheaper labor of parts of Europe and Asia, there is no reason why, with proper intelligence, we may not produce our own silk as cheaply as it can be brought here from those countries; and I am convinced that, should we ever be cut off by war from those countries on which we rely for our present silk supply, we can easily fall back on our own resources. Even now, there is no reason why the young people, and those unable to do harder work, in thousands of families, should not spend a few weeks each year in the pleasant work of producing cocoons.

Of the eight species which will be treated of, four, namely, *mori*, *cynthia*, *yamamai*, and *Pernyi*, are of foreign origin; and the other four, namely, *Cecropia*, *Promethea*, *Luna*, and *Polyphemus*, are native. When newly hatched, all of them, even to the mulberry species, are, in form and structure, exactly alike; and they differentiate more and more as they increase in size, until each acquires its specific characters.

All these silkworms cast their skin four times during the feeding period, and thus have five different stages of growth; the worm resting and fasting from one to three days, then gradually working off the old skin, and afterwards knocking off the head.

They all, when in the cocoon, are furnished with an acrid or bombycic fluid, with which they weaken the resisting force of their cocoons, and facilitate the exit of the moth; though those which make rounded or closed cocoons are much more amply supplied than those which form pointed or open ones.

All the cocoons, whether pointed or rounded, are spun in one continuous thread. In issuing, the moths of all of them rupture, more or less, the threads of the cocoon, thus rendering it valueless for reeling. Many writers assert to the contrary; but I have examined no deserted cocoon which has not shown some broken threads, and have witnessed the threads break during the emergence of the moth. Such as are naturally open are broken less than the others; but if only a half dozen threads are sundered, the cocoon is spoiled for reeling purposes. All the native cocoons are at times found drilled with large holes, and gutted by birds or squirrels; and those which fall to the ground are frequently destroyed by mice, rats, and moles.

In manufacturing silk, the cocoons are subjected to steam or to heat in order to destroy the vitality of the chrysalis, which would otherwise bore out and break the silk.

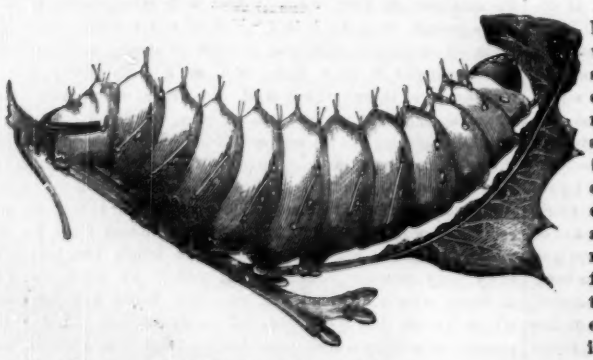
All the moths are night flyers. All the large heavy worms, when full grown and in a state of nature, hang on the under side of leaves and twigs, being too heavy to sustain themselves in an upright position. They are all of some shade of green—no matter what their color when younger—and in a measure similate the leaves of their food tree, so as to render detection difficult.

It is a little singular that the principal trees which may be used for producing the best silk, namely, the mulberry, osage orange, and ailanthus, are all three of them remarkably free from the attacks of other insects.

By judicious breeding and selection, I believe that the native worms may be improved in their silk-producing qualities, and that the foreign ones may be acclimatized and better adapted to our conditions.

THE POLYPHEMUS SILKWORM—*Attacus* [*Telea*] *Polyphemus*, LINN.—(*Lepidoptera, Bombycidæ.*)

This insect has been styled, with much justice, "the American silkworm" by Mr. L. Trouvelot, of Medford, Mass. That gentleman made a series of very interesting experiments in rearing the worm in large quantities in the open air, and in 1865 he had not less than a million feeding upon bushes covered with a net. An interesting account of these experiments, but more especially of the natural history of the species, may be found in the first three numbers of that excellent periodical, the *American Naturalist*.



THE POLYPHEMUS SILKWORM.

The eggs of *Polyphemus* are deposited singly, or in twos or threes, on the under side of a leaf or upon a twig. They are whitish, inclining to flesh color on the top and bottom, and encircled on the sides by a characteristic broad band of amber brown, which is the natural coloring of the egg shell and distinct from the brown fluid which is secreted with them and fastens them to whatever object they are consigned. This brown band has a narrow pale spot at the two smaller ends. The moths issue with us the latter part of April or in May, and the female commences depositing very soon afterwards. The eggs hatch in about ten days after deposition.

The worm feeds on oak, walnut, hickory, basswood (*Pilia*), elm, maple, hazel, apple, rose, quince, thorn, plum, choke cherry, sycamore, poplar, birch, honey locust, blueberry, and willow, on the first nine of which I have found it myself. When full grown, it is a most delicate and beautiful object, being of a clear apple green color, with oblique yellow lateral lines, and tubercles tinseled with orange, gold, and silver. The head, spiracles, legs, and ends of prolegs are of a buff yellow, the front edge of the first joint sulphur yellow, and the edges of the anal shield purple.

COCOON OF THE POLYPHEMUS SILKWORM.

The cocoon is formed of strong silk which, when unwound, has a glossy fiber. It is oval and closed at both ends, dense and generally fastened to a leaf or leaves, with which it falls to the ground, though sometimes it is fastened to twigs and therefore remains exposed, during the winter, to its enemies. The exit of the moth has been well described by Mr. Trouvelot:

"The moth is provided with two glands opening into the mouth, which secrete, during the last few days of the pupa state, a fluid which is a dissolvent for the gum so firmly uniting the fibers of the cocoon. This liquid is composed in great part of the bombycic acid. When the insect has accomplished the work of transformation which is going on under the pupa skin, it manifests a great activity, and soon the chrysalis covering bursts open longitudinally upon the thorax; the head and legs are soon disengaged, and the acid fluid flows from the mouth, wetting the inside of the cocoon. The process of exclusion from the cocoon lasts for as much as half an hour."

CHRYSALIS COVERING OF THE POLYPHEMUS SILKWORM.

The moth is of a dull ocher yellow, shaded more or less distinctly with innumerable black particles, and with a broad gray band along the front, or costal edge, and passing over the thorax. There is a darker, reddish brown shade across the middle of the wings, and near this shade on each wing is a transparent eye-like spot, divided by a slender opaque line, and margined by a yellow and a black ring, the last much broader on the hind than on the front wings, being there widened on the inside into a large black spot with the part adjoining the eye-spot blueish white. Near the hind margin of each wing is a dusky band (blueish on the front ones), edged with pink white behind: and near the base of the front wings is a zig zag crimson line, edged inside with white. There is a great variation in the colors of this insect, dependent in some measure no doubt, on the food of the larva. Specimens occur which have the general tint either very dark or very pale; either brown, smoky yellow, cream color, rust red, or greenish; while the large black spot on the hind wings is sometimes replaced by rust red.

The male is easily distinguished from the female by his smaller abdomen and very broad antennæ, which are, in fact, broader than represented in the annexed figure, as they have been known to spread nearly half an inch. They have actually been mistaken for a third pair of wings by inexperienced persons.

The principal difficulty in the way of reeling the cocoon of *Polyphemus* is the hard matter which binds it; but it is not an insurmountable one, and the cocoon could no doubt be improved by a proper process of continued selection. The silk is strong and lustrous.

As with some of the other species already mentioned, two broods of this insect are frequently produced each year in this latitude, though it normally appears to be single brooded in the more northern States. In the South it is always double brooded, the first moths issuing about the middle of February in Louisiana. If it is ever grown for silk, the South will be the most favorable part of the country, for it often abounds in New Orleans in such numbers, on sycamore, elm and live oak, especially the latter as to be easily gathered by bushels.

POLYPHEMUS MOTH, MALE.

Locomotive Boilers.

During the recent meeting of the Master Mechanic's Association, the subject of boiler construction for locomotives received earnest discussion. The merits of the plain circular boiler and the wagon top boiler were also examined. The form consists in a swell or elevation of the boiler above the fire box. On this and other features, the *Railroad Gazette* observes:

The location of the domes, too, is an element which must be taken into consideration. If there is but one, and it is located over the fire box, where the ebullition is most violent, there must necessarily be more steam room, to prevent the water being carried into the steam pipe, than would be required if the dome were over the tubes. The variation of water level due to the inclination of the track and the surging of the water will be greatest at the ends of the boiler and least in the center.

On merely theoretical grounds, therefore, it seems probable that the steam taken from a dome located in the center of the boiler would be drier than if taken from a point over the fire box, and this would seem to indicate that the evils complained of in straight top boilers are to a very great extent due to the fact of taking steam from a dome over the fire box instead of the center of the boiler. Now if we keep carefully in mind the importance of comparing the weights instead of the dimensions of boilers, and then remember that one with a straight top of a larger diameter will weigh no more than a wagon top boiler of a smaller size, we will see that, with the dome located in the center, the straight top boiler has an advantage over the other. The question thus becomes: whether steam taken from a dome located in the center of a boiler of larger diameter will be drier than if taken from one over the fire box of a boiler of smaller diameter with a wagon top. The advantage claimed for wagon top boilers of greater steam room and water capacity is gained equally well by the enlargement of the diameter of the straight boiler. The distribution of weight on the driving wheels, it must be admitted, with the present arrangement of boiler and engine is in favor of the wagon top, and locating the dome in the center increases the disadvantage in this respect of the straight boiler. It is also claimed that the wagon top gives more room, and consequently, makes the crown bars, crown sheet and braces more easy of access when they need repair or cleansing. The former advantage, we believe, could be more fully realized by a different arrangement of boiler, of which we will speak at some future time, and the latter by a different construction of crown sheet and braces. In this connection, it might not be unwise to observe that in European practice wagon top boilers are now almost unknown, and domes, or their equivalent, are almost always located on the centers of the boilers.

In considering the subject of locomotive boiler construction, we should never forget, what is now, we believe, generally admitted, that the larger the boiler, the more economically will it consume its fuel. For this there seem to be two reasons; first, the combustion is slower, and consequently more perfect, and the flames and smoke are thus in contact with the heated surface a longer time, and therefore impart more of their heat to the water; second, the water capacity of a large boiler being greater than of a small one, there is more hot water stored up for use when the maximum power of the engines must be exercised, and therefore the fire need not be forced so much as it would be if it were necessary to generate all the steam consumed at such times as fast as it is used.

HOW TO DESTROY THISTLES.—While giving botanical evidence in some thistle prosecutions, Dr. Daniel Bunce, curator of the Geelong Botanical Gardens, stated that an infallible way to destroy thistles was, just before the bud began to form, to cut the root through with a spade about 2 inches below the surface; also that the practice of cutting them above the surface was an utter waste of both money and labor, as thistles thus treated invariably sprang up again with a greater number of heads than before.

ENGLAND has as many people in the almshouse as she has children in schools.

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THE MANORA BREAKWATER.

From previous accounts of works now being carried out under Mr. W. Parkes for the improvement of Kurrachee harbor, in Scinde, India, it will be remembered that a breakwater from Manora Point forms one of the most important features of the undertaking, its object being to protect the entrance of the channel leading into the harbor. The breakwater is not yet sufficiently advanced to have produced the full beneficial results to be expected from it, but its stability as a structure has thus far been already fairly tested. The general principle of the breakwater is that of a bank of rubble stone laid upon the natural bottom and brought up to a level of 15 feet below low water, but near the shore, where the original depth is less than this, to ten feet below low water. Upon this bank of rubble stone, a superstructure is raised, consisting of blocks of concrete each, 12ft. × 8ft. × 4½ ft. and weighing 27 tuns, set upon the narrowest side so that the whole superstructure consists of two blocks in width and three in hight, forming a solid wall, with vertical sides 24 feet wide and 24 feet high. The blocks are set in place by means of an overhanging crane.—*Engineering.*

THE MANORA BREAKWATER, KURRACHEE HARBOR, INDIA.

Old Rags.

First and foremost of the many applications of this humble material is the manufacture of paper; for this purpose England alone uses not less than 85,000 tuns of rags and waste, representing a money value of about $3,500,000. The transformation effected by the action of certain chemicals on paper is very striking. A sheet of common white blotting paper, which will scarcely bear its own weight when wetted, is converted in a few seconds, by the action of sulphuric acid, into a substance possessing all the properties of ordinary animal parchment, and so strong that it can be only broken with difficulty. Great as this change is, strange to say no chemical alteration has really taken place; the acid merely produces a molecular change, and is entirely washed away at the end of the process. Rags from woolen materials undergo many peculiar metamorphoses; old clo' criers first collect them; they are then successively converted into mungo, shoddy, and devil's dust, and reappear as ladies' superfine cloth; they then degenerate into druggets, and are finally used for the manufacture of flock paper. After undergoing all these transformations, they are used by the agriculturist as manure, on account of the large amount of nitrogen they contain. The presence of this element makes them of great use, also, to the chemical manufacturer; he boils them down with pearlash, horns and hoofs of cattle, old iron hoops, blood, clippings of leather, and broken horseshoes, and produces the beautiful yellow and red salts known as prussiates of potash. From these, again, the rich and valuable pigment called Prussian blue is made, and thus do our old rags enter upon a fresh career of beauty and usefulness, to form, in their turn, other waste products, which may again be utilized through the power of man's intelligence.

Bones and their Products.

Bones are composed of half their weight of phosphate of lime, about a third of their weight of cartilage or gelatin, and the remainder of earthy matters. The gelatin is extracted by boiling water under pressure, and is used to stiffen calico, etc.; when purified, it constitutes the nutritious aliment known as calf's foot jelly.

When the bones are heated without access of air, the organic matter of the cartilage is decomposed, oily products passing over, and a black, carbonaceous residue being left; this is bone black, or animal charcoal, greatly used as a deodorizer and disinfectant. Bones, when calcined and heated with sulphuric acid, yield superphosphate of lime, so highly esteemed as a manure. The last, and certainly the most important, application of bones is the manufacture of phosphorus. The bones are first burnt, to remove all traces of animal matter; the resulting bone earth, as it is called, is then subjected to the action of sulphuric acid, by which superphosphate of lime is produced. This acid phosphate is then mixed with charcoal and strongly heated in a retort, when it splits up into normal phosphate and phosphoric acid, the latter being finally reduced by the charcoal to phosphorus, while hydrogen and carbonic oxide are liberated as gases. The combustible and poisonous properties of phosphorus make it very dangerous to employ in the arts; but Professor Schröter discovered that when ordinary phosphorus was heated for some time in a closed vessel to a temperature of 470°, it lost its power of igniting spontaneously, and became of a deep red color. By making use of this discovery, matches can now be made without danger, either to those who manufacture them or to those who use them. The safety match is made by putting the oxidizing material alone on the match, the red phosphorus being mixed with emery and pasted on the side of the box.

The Luminiferous Ether.

Though compelled to think of space as unbounded, there is no mental necessity to compel us to think of it either as filled or as empty; whether it is filled or empty must be decided by experiment and observation. That it is not entirely void, the starry heavens declare, but the question still remains: Are the stars themselves hung in vacuo? Are the vast regions which surround them, and across which their light is propagated, absolutely empty? A century ago the answer to this question would be: "No, for particles of light are incessantly shot through space." The reply of modern science is also negative, but on a somewhat different ground. In support of the conclusion that the celestial spaces are occupied by matter, it is able to offer proofs almost as cogent as those which can be adduced for the existence of an atmosphere round the earth.

The notion of this medium must not be considered as a vague or fanciful conception on the part of scientific men. Of its reality, most of them are as convinced as they are of the existence of the sun and moon. The luminiferous ether has definite mechanical properties. It is almost infinitely more attenuated than any known gas, but its properties are those of a solid rather than of a gas. It resembles jelly rather than air. A body thus constituted may have its boundaries; but, although the ether may not be co-extensive with space, we at all events know that it extends as far as the most distant visible stars. In fact it is the vehicle of their light, and without it they could not be seen. This all pervading substance takes up their molecular tremors, and conveys them with inconceivable rapidity to our organs of vision. It is the transported shiver of bodies countless millions of miles distant which translates itself in human consciousness into the splendor of the firmament at night.

If the ether have a boundary, masses of ponderable matter might be conceived to exist beyond it, but they could emit no light. Beyond the ether dark suns might burn; there, under proper conditions, combustion might be carried on; fuel might consume unseen, and metals be heated to fusion in invisible fires. A body, moreover, once heated there, would continue for ever heated; a sun or planet once molten, would continue forever molten. For, the loss of heat being simply the abstraction of molecular motion by the ether, where this medium is absent no cooling could occur. A sentient being, on approaching a heated body in this region, would be conscious of no augmentation of temperature. The gradations of warmth dependent on the laws of radiation would not exist, and actual contact would first reveal the heat of an extra ethereal sun.—*Tyndall.*

Economical Steam Power.

The trial trip of the new screw steamer, *Torino*, built by Messrs. Oswald & Co., of Pallion shipyard, Sunderland, has lately taken place. The steamer is for the Italian Lloyd's Company, and of the following dimensions: Length between perpendiculars, 270 feet; breadth, 33 feet; depth of hold, 21 feet; register tunnage, 1,553 tuns. She has a draft of water forward of 7 feet 10 inches; aft, 11 feet 2 inches. The vessel is fitted with all modern appliances for increasing the comfort of passengers and the capacity for cargo, and is specially designed to attain a high speed under steam with a small expenditure of power. Her engines, which have been made by the builders of the vessel, are of 160 horse power nominal, of the inverted cylinder, compound, surface condensing type, the cylinders being 34 inches and 64 inches in diameter respectively, with a stroke of 3 feet. It was found that under 1¾ lbs. of coal per horse power per hour was used, which small quantity may be traced to the introduction of Messrs. Oswald's feed heating apparatus, which increased the temperature of the feed water to 185°, the heat being extracted from the exhaust steam by injecting the feed water through it in a vessel connected with the exhaust pipe, thus utilizing a quantity of heat which would otherwise have been lost. There are two boilers on the cylindrical return tube principle, constructed for a working pressure of 65 lbs. per square inch. It was observed as a result of the trial that the mean speed was 10 9 miles per hour, which included the time lost for priming, etc The average revolution of the engines showed 67; average steam, 62; vacuum 26; indicated horse power, 753; temperature of feed water 185°, with patent feed heater. The trial was considered eminently satisfactory.

A HUMMING bird flew into a court room in Georgia during the session of the court one day recently, at 10½ A. M., and continued to fly within a few inches of the ceiling until six P. M., when it fell slowly and lighted on a mantelpiece, where it was captured. It was on the wing seven and a half hours without rest.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Propagation of Roses.---Dwarf Pear Culture.---Ornamental Trees and Shrubs.---Manufacture of Ladies' Apparel.

To the Editor of the Scientific American:

Last week I took an excursion through Monroe and Wayne counties, N. Y., visiting several fruit nurseries and flower seed gardens, and one novel manufacturing establishment, and witnessing practical application of scientific principles to the production of fine fruits and flowers, not less interesting than those involved in the construction of steam engines or the propulsion of canal boats. Moreover, I found an evident willingness, on the part of those who have subjected theories to the test of experience, to impart their dearly bought wisdom to others, thus smoothing for their successors in the business the rugged way over which they have themselves achieved success, and contributing to the higher development of their noble calling. The method of

PROPAGATING ROSES

was minutely described and shown by Mr. John Houston, the skillful propagator at the extensive ornamental and small fruit nursery of A. M. Purdy, Palmyra. This work is done at any time during the season in the greenhouse. I saw plants which were set early in the season and had made considerable growth, others set at various times since, and others still, cut from the bushes and set while I was looking on. Good thrifty shoots from six to twelve inches long were cut and laid in a market basket, sprinkled, and covered with two or three thicknesses of wet paper. They were next taken into the workroom attached to the greenhouses and there cut with a thin bladed keen pocket knife into pieces from one inch to two inches in length, and thrown into water and left from one quarter to one half hour. These cuttings are made with a smooth, somewhat oblique cut, so as to leave but one bud to each, and that at the upper end. The leaf at the base of the bud is cut away, except the two lower leaflets. After having lain in water until all the pores are filled, they are set in coarse sand in the smallest crocks, one in each, or several in a large one. The subsequent treatment consists in keeping them uniformly moist and warm, too much or too little water being injurious. After the cuttings have taken root, they are transferred to larger crocks or to the garden beds. Persons wishing to propagate roses on a small scale may substitute a bottomless box with a light of glass over it for a greenhouse. A writer in *The Garden* says he has succeeded finely by putting a dozen or more cuttings in coarse sand in a marmalade jar, with water enough to stand about a quarter of an inch above the sand, and plunging the jar in a slight hot bed, giving all the light and sun possible, and adding a little water occasionally to replace that lost by evaporation.

Mr. Purdy has 130 acres of rolling land, with soil of sandy loam, devoted to small fruits and ornamental shrubs, probably the largest small fruit nursery in the country. The acres of Mammoth Cluster black cap bushes, literally covered with thimbles of jet, were a sight for an epicure.

From Palmyra, I rode north six miles through a fine farming section, along the line of a projected railroad from the Ontario iron mines by the New York Central to Walworth, a lovely little village which crowns the summit of one of several parallel north and south ridges. Almost encircling and imbosoming the village are the nurseries and orchards of T. G. Yeomans, Esq., to whom, with his estimable family, I am indebted for two days of rare enjoyment in studying the results of twenty years' thorough and systematic devotion to the cultivation of fruit trees and fruit. Though equally successful in raising all other orchard trees and fruits, Mr. Yeomans is without doubt unrivaled as a cultivator of

DWARF PEARS.

From 400 to 500 barrels of pears is the ordinary product of his orchards. The "Duchesse d'Angoulême" is his favorite variety. They are very large, a barrel having been filled with 125 pears. They are delicious and always marketable, $1,000 having been received for the product of one third of an acre for two years. Quince roots are imported from France. These are set in spring and budded in summer, or grafted the following winter and reset in spring. Clean cultivation follows for two or three years, when the trees are ready for the orchard. The "Bartlett," "Louise," "Bonne de Jersey," "Howell," "Seckel," "Sheldon," and "Vicar of Winkfield" are considered next in value to the "Duchesse."

Mr Yeomans relies on thorough preparation of the soil by underdraining, manuring, deep and frequent plowing before planting, and clean cultivation, frequent stirring of the soil, and skillful pruning afterwards for success in fruit raising. As an illustration, he has laid four miles of tile drain on fourteen acres of lately purchased land. Cultivators and small plows are kept in operation all the season through, the ground being thus kept mellow and clean as a garden. The most perfect system prevails in all parts of the establishment, and one who visits it is at no loss to know why the products of these grounds are so eagerly sought for. The reason is simply this: The very best varieties are cultivated in the very best manner and sold for what they really are, Varieties which he has thoroughly tested and found the best, Mr. Yeomans raises largely. Of the Baldwin apple, for instance, he has entire blocks in the nursery and over sixty acres of orchard. His entire apple, pear, and peach orchards contain over 14,000 trees. A full crop of apples is about 3,000 barrels; of peaches, 1,000 bushels. Every peach tree is full of fruit.

At Walworth, and also at several of the Rochester nurseries, I took note of such

ORNAMENTAL TREES AND SHRUBS

as pleased me most. Omitting those well known, I will name a few, any of which may be safely ordered by those who wish to add a rare and beautiful ornament to their lawns. The cut leaved birch has a graceful form, light drooping foliage, and smooth silvery bark which contrasts finely with the foliage. The red leaved beech is among trees what the *coleus* is among plants. The honey locust is a rapid grower and a beautiful tree. The *Salisburiana adiantifolia* is remarkable for its peculiar fan shaped leaves. The magnolia and catalpa are fine trees. The *Wigelia rosea, Spirea prunifolia, Deutzia crenata, Deutzia gracilis,* Japan quince, and red leaved barberry are very desirable shrubs.

While at Rochester I visited the establishment of Messrs. Elwell & Moseley, manufacturer of ladies' suits and underwear. They are pioneers in the business. They have already secured an extensive trade, their orders being from almost every State in the Union. In the machine room are stands for 120 sewing machines, which are run by water power, the operator starting or stopping the machine by a slight pressure on the treadle, one foot crowding the band wheel against a disk attached to the shaft, the other removing it. Hemming and puffing are done with the Wilcox & Gibbs machine at the rate of 2,000 stitches per minute. For other work, the Singer, Wheeler & Wilson, Howe, and some other machines are used.

Much of the more elaborately wrought parts of under garments is formed by carefully stitching together narrow strips of bias tucking, puffing, insertion, and edging. The tucking is prepared by laying fine tucks obliquely in two yard pieces of cloth, and then cutting into narrow strips lengthwise. The material used is Victoria lawn, linen, and grass cloth. The wonderful feature of the establishment is that by the aid of machinery and proper division of labor, beautifully wrought garments are made and sold at less prices than the very plainest articles can be made for by hand. Now that ladies' garments have begun to be manufactured by the dozen and hundred by machinery, we may look to see the needle banished to the garret along with the spinning wheel and loom.

C. H. D.

Warsaw, N. Y.

[For the Scientific American.]

NOTES OF ENGLISH SCIENCE.

The treatment of sewage is calling forth a good deal of enterprise. The method adopted by the Peat Engineering Company is to treat with charcoal, a tun of which, they calculate, is equal to the absorption of at least two tuns of solid sewage matter. The mixture is reduced to powder and packed in bags for conveyance or storage. This mode is being applied at Bradford to a sewage of 5,000,000 gallons daily, including waste liquors from numerous dye works and factories. The liquid will be filtered through charcoal arranged in several rows of beds 700 feet long and 4 feet wide, each particle of sewage passing through twelve feet of charcoal. The same company are about to treat the Paris sewage, and offer for the solid *excreta* the high price of 6 francs 7 centimes per cubic meter. The Nuneaton sewage is about to be treated by Anderson's process, in which the sewage is admitted into tanks, and sulphate of alumina, dissolved in water, is thrown in, followed by a little slaked lime. Sulphate of lime is formed, and the alumina is set free. Precipitation follows; the water is run off, and the mud discharged into baskets, of galvanized iron wire lined with flannel, which act as strainers. These, when full, are lifted and the deposit is thrown on a sheet iron floor, heated from beneath with hot air, which, after heating the plate, is drawn back over the surface of the mud, and carried into the flue of the engine furnace. The dried mud forms the manure. Dr. Anderson says that at Nuneaton eight to ten tuns manure can be produced weekly at a cost of £7, including everything.

The Council of the Society of Arts offer prizes of £60, £20, and £10 for the best improved cabs, to be exhibited at the International Exhibition in 1873. The London cabs are thought faulty in the following respects: 1. Want of room. 2. Seats in four wheelers too high, not commodiously made, and the space underneath lost. 3. Difficulty of getting in and out of hansoms from hight of step and interference of wheel. 4. Window arrangements in hansoms are bad. 5. The confined, ill ventilated space in hansoms when the window is closed. 6. Imperfect locking of wheels in four wheelers.

The Prince Consort memorial in Hyde Park is approaching completion. It was designed by Mr. Gilbert Scott, R.A., and its estimated cost is £120,000. The monument is elevated on a pyramid of steps, on the upper platform of which rises a pedestal surrounded by sculptured figures. Four pillars of polished granite bear aloft the four main arches of the canopy. The upper part consists of a lofty spire of "tabernacle work," largely gilt and enameled, and terminating in a gilt cross which reaches the hight of 180 feet above the ground. Each side of the canopy is terminated by a gable containing a large picture in mosaic. Various sculptured groups represent Architecture, Painting, Poetry, Agriculture, Commerce, Engineering, etc. The figure of the Prince Consort is not yet placed, and is not likely to be for another year.

A remarkable method of preparing wood pulp for the manufacture of paper is exhibited by Mr. Houghton at the International Exhibition. The logs or blocks of wood, preferably pine, are cut into small pieces about one inch by one half or one fourth of an inch. These are treated with alkali at a temperature of 370° to 380° Fahr. (equivalent to a pressure of 175 to 180 pounds per square inch). All resinous and other matter is thus dissolved out, and the skeleton fibrous framework of the wood collapses into half stuff, under compression, with moisture. The wash liquor is treated (in accordance with a discovery made by M. Tessié du Motay) so as to be utilized again, and this is the essential principle of the process. Carbonic acid gas is forced through the liquor, forming a resinous precipitate, which falls to the bottom on application of heat. The supernatant fluid remains still colored by some vegetal acids, and these are removed by introducing sulphate of soda, a cheap salt. The caustic alkali is thus made fit for use again.

A new mode of paving, called lignomineral, is about to be tried in one of the London streets. It consists of wood blocks impregnated with mineral substances, which make them impermeable to wet and homogeneous. The foundation is prepared with concrete, and the interstices between the blocks are solidly filled in with gravel. The blocks are beveled at the end to an angle of 60°, and those of adjacent rows are inclined in opposite directions. Cheapness and endurance are said to be the benefits of the system. It has been tested in Paris, with excellent results.

The Australian Telegraph Company have announced their readiness to receive telegraphic messages for Australia and New Zealand, at the sender's own risk. The land line is not yet complete, but by means of an express service, news may be received in Adelaide five days after London dates. The work of construction in Australia has been divided into two parts, one from Port Darwin southwards, the other from Port Augusta northwards; of the former 400 miles have been constructed, of the latter, 1,176 miles, leaving 250 miles incomplete. Great difficulties have been experienced from floods. If one walks a mile or two from the camp, he may find, on attempting to return, that he is almost cut off by creeks and water courses, which before had no existence. The rainy season would thus seem to threaten interruption to the line when constructed. Iron poles will further be wanted all through tropical Australia, on account of the ravages of the white ant. The company wishes to carry a submarine cable from Port Darwin to join the Queensland lines in the Gulf of Carpentaria.

A. B. M.

LONDON, July 8, 1872.

Saliva.

The action of the saliva in turning the starch of the potato into sugar is tolerably well known to students of popular science; but few among the ordinary reading public are aware that this saliva consists of a variety of fluids, some of which prepare or predispose the food to change, while others merely serve mechanical objects. Of these the saliva secreted by the parotid glands contains a peculiar ferment named ptyaline, and this principle is the only agent in saliva which has the power of transforming starch into sugar. The diastase of malt has a similar action, and a knowledge of this fact led Baron Liebig to employ diastase in the preparation of a food for infants "brought up by hand," which food supplies efficiently the want of ptyaline and alkaline fluids in the digestive juices. But little is known of the character of saliva in disease; that it is very materially affected cannot be doubted, and further research will probably throw more light on the subject. It is known that the administration of mercury causes a change in its constituents; several medicinal salts, such as iodide of potassium, pass very readily into the saliva from the blood, and, as is well known, the saliva is the bearer of the poison of hydrophobia. From these facts we derive information of a nature probably unthought of by many; for if ptyaline be the only substance in the human economy which can turn starch into sugar—for the gastric juice cannot, and the pancreatic fluid has only a trifling influence in this direction—we see at once how necessary and important it is to thoroughly masticate all food containing starch, not only in order to obtain the full nutritive value of what we eat, but also to prevent overloading the stomach with a mass of food, much of which is probably indigestible.

Canadian Canals.

The New Dominion Government, with a wisdom and foresight which can hardly fail to promote the largest results, is turning its financial prosperity to good account by projecting a series of public improvements on an extensive scale. It is not generally known that the St. Lawrence River above Montreal is not navigable, and that transportation is chiefly by means of canals. These canals were constructed at intervals to meet local wants, and are without uniformity or system. Vessels fully loaded passing through the Welland Canal must discharge part of their cargo, nearly one half, in order to go through the St. Lawrence canals to Montreal. It is intended to enlarge all the canals to a uniform size and depth, so that vessels of 1,000 tuns can pass with full cargoes from the Upper Lakes to tide water. This will be the nearest approach to direct trade between the lake cities and Europe which has yet been attained, and opens up the prospect of a formidable competition between Montreal and New York. Comparatively few vessels will make the voyage from Chicago to Liverpool. It will rather be to the interest of shippers to forward grain to Montreal for reshipment by regular ocean vessels to Europe. The lengthy inland navigation, partly by river with strong currents, and partly by canal, will be only favorable to steamers which it would scarcely be worth while to adapt to the exigencies of the ocean. The consequence is that Montreal is likely to become a great grain distributing port in the immediate future.

THE new postal rate, on transient newspapers, pamphlets, circulars, cards, photographs, roots, cuttings, etc., is 1 cent for each two ounces.

The Magnetic Needle in Mineral Explorations.

Major T. B. Brooks, who has had much experience in the use of the compass as an aid in the exploration of iron bearing localities, recently gave a very interesting paper on the subject before the American Philosophical Society, Philadelphia. In these explorations, the ordinary compass and the dip compass may be used to advantage, and the author is of opinion that by their employment not only can the presence of underlying veins of iron ore be determined, on passing over the surface of the ground, but also the order of superposition or succession of beds of iron bearing rocks. He does not undertake to say that by means of the magnetic needle it is possible to tell whether we have a workable merchantable deposit of iron ore under our feet; but this is certain, that the needle will enable us to trace the course of the iron bed until we come to some outcrop of the mineral, and then we may be able to determine its value. The distance through which a local magnetic pole or bed of iron ore will affect the needle depends on the intensity of the attraction of the bed, and on the position in which the needle is placed. The maximum influence is observed when the needle is moved east or west of the ore bed. The influence of the magnetic rocks at Republic Mountain has been observed at a distance of 2,500 feet horizontally.

The thickness of rock or earth which covers the iron deposit can, the author thinks, be determined by the needle in the following manner:

Remote from any magnetic rocks, neutralize, by means of a bar magnet, the earth's influence on the needle of a solar compass. The needle will then stand indifferently in all directions, and will not vibrate. Record carefully the distance and position of the neutralizing magnet; the compass is then ready for use. Set it up near the magnetic pole to be determined, and fix the magnet in exactly the same relative position it had before. The earth's directive power on the needle will again be neutralized, and the needle will point as near towards the local pole as its mode of mounting will permit; mark the line indicated by the needle on the ground; remove the compass to one, or, better, two other positions, and repeat the operation. If there is no other local force to interfere, the three lines must intersect in one point, which will be directly over the pole whose position is sought. By using a dip compass in a similar manner, it is evident that the data to determine the depth, by the simple solution of a triangle, would be obtained.

A solar compass must be used to fix the position of the artificial magnet used in neutralizing the earth's force, or it may be fixed by an observation on the north star, or from a meridian line brought in from a non-magnetic area.

When considering the magnetism of the rocks of the four great geological epochs represented on the upper peninsula of Michigan, I observed that considerable magnetic variations were noted by the Federal surveyors, over rocks of silurian age, which had never been observed to be in themselves magnetic. In some instances these variations had been observed over a limestone, supposed to be Trenton, and at a distance of 75 miles from the nearest Huronian or other (known to be) magnetic rocks.

This phenomenon may be due either: 1. To the presence of magnetite in such rocks, due to local metamorphism or other cause. 2. To accumulations of magnetic sand in the drift. 3. To the underlying Huronian rocks, which may be supposed to exert their influence up through the overlying silurian.

Without having made a study of any of these localities, I incline decidedly to the latter hypothesis, as embracing the known facts better than either of the others.

Should this prove true—and I hope to settle it the present season—it may lead to a novel and interesting application of the science of magnetism to some of the most important questions of geology—the determination of the thickness of sedimentary rocks by magnetic triangulation in places where it would otherwise be difficult to arrive at such thickness. It might also enable us to work out the structure and distribution, in a rough way, of those oldest rocks which underlie great silurian areas, which would in no other way be possible, thus throwing light on the nature of the rocky bottom of the ancient seas.

On the same principle we can, of course, trace magnetic iron belts under water. I have in many instances made very satisfactory magnetic observations from a canoe in the inland lakes of the upper peninsula.

The bottom of Lake Superior may be partially mapped out in the same way. Silt and sand will make no difference with the needle; it looks through everything but iron.

New Material for Bricks.

During the last few years, experiments have from time to time been made with the view to utilize in some way the mounds of shale (the refuse of the coal mines) which cover an area of several thousands of acres in South Staffordshire, England, by converting them into bricks. Several enterprising firms have already embarked in this novel but profitable business. When properly pulverized, the shale is found to be an excellent material for the purpose, the bricks produced being hard and durable, resembling in color the fire clay bricks of the Stourbridge district, although for furnace and such like purposes they are not so valuable. For ordinary building, however, they are found to be of equal practical value to the ordinary red bricks. The material is to be had in any quantity for a mere nominal sum, and there is every reason to believe that this method of utilizing the innumerable dusky hillocks which disfigure the South Staffordshire landscape will gradually develop into an industry of some importance.

Cheap Concrete Houses.

The latest method of concrete building, as practised in Scotland, is thus described by the *Aberdeen Journal:*

The whole process of building houses of concrete is so exceedingly simple that the employment of skilled labor is quite unnecessary. A foundation having been laid, a double framework of wood, or paneling, 9 inches apart and 18 inches high, is placed above the foundations round the entire building, forming a kind of box. This paneling consists of pieces of wood, varying in breadth from 3 or 4 inches to over 1 foot, with a bead on the upper edge having an aperture by which the pieces are slid on to an iron rod. Being thus telescopic in construction, the pieces of wood can be lengthened or shortened according to the extent of the building. At intervals between the panels are placed upright bars, called separating posts, several feet high, through which the iron rods supporting the panels pass and are secured. At equal distances of 18 inches, ascending upwards, there are apertures in the posts for the insertion of the iron rods, and the paneling round the entire structure can be raised with great ease as the building advances. When operations are to be commenced, a quantity of packing, which may consist of rough stones of any shape, the more rugged the better, which forms the first layer of the building, is thrown in, care being taken to keep the packing 1 inch from the face of the work, so that it may not show through it. When the 18 inches of packing are filled up, the concrete, which is in a semi liquid state, like mud, is poured into the box and percolates down through the stones, thoroughly filling all cavities, and binding the stones and rubble together so tightly that the whole forms one solid mass. For a day, the portion of wall thus made lies encased within the paneling. By that time it has become quite dry, and the paneling or frame is taken off and lifted up other 18 inches, the bottom of the frame resting where the top was before. Thus another box is formed above the piece of finished wall, and identically the same process which we have described is repeated, stones and rubble being thrown in, and the liquid cement being poured over them. In this way 18 inches of building are finished each day if the weather be good, so that in the course of a week the walls of a cottage 8 or 9 feet high are strongly and firmly built.

When the paneling is screwed together to the separating posts, it is so mathematically exact, owing to its careful structure, that the wall is built as straight as if tested with a plumb line. Indeed, it cannot fail to be so, and it is interesting to note that the whole building is finished without the aid of a plumb line, which is quite unnecessary.

A noteworthy feature in connection with the building of these concrete houses is that the usual cumbrous and often dangerous scaffoldings which are used in erecting ordinary buildings is superseded by a much better, more secure, and much less unwieldy arrangement, by which ropes are entirely dispensed with. Little hollow iron tubes, called cores, are placed in the walls, through which iron rods are inserted, connected with brackets which are securely attached to the wall, being firmly screwed through the building with nuts. The brackets are just similar in form to supports used for shelving, and on the top of the brackets are laid the planks for the scaffolding, forming altogether a neat and strong support.

Two cottages, which are built as one, are 32 feet in length by 22 feet, and 8 feet high. In each cottage there are three rooms, those in the front being about 12 feet square, and the back rooms measuring about 7 feet by 12. The cottages are lighted by two windows in front, and four in the back. The flooring is of concrete, which, being thoroughly impervious to moisture, makes the apartments very dry and comfortable. It is intended to have the roof built in the ordinary way with rafters and slating, but it is not uncommon for concrete to be used as a roofing material, for which purpose it answers very well. The outside walls, when built, are finished with a coating of concrete, about a ¼ of an inch thick, a little finer in the quality than that used for the ordinary building, which gives a smooth finished appearance to the structure. No supports are requisite for the lintels of the doors or windows, because after the concrete is hardened, it is stronger than any support of wood or stone. When the building is in progress, spaces are left for the joists, which are temporarily filled with sand, which is easily removeable at any time with a trowel. The spaces for the joists are made alternately 3 inches and 6 inches in depth, on each side of the building, which diminishes the pressure on the walls considerably.

Houses finished in the way we have described are much cheaper than those built in the ordinary way, the saving being from 35 to 40 per cent. The buildings, at the same time are more comfortable, because, being impervious to moisture and heat, they are warm and dry in winter, and cool during summer. The rooms can be papered over the bare walls, no lath or plaster being required, though a coating of plaster in no way affects the concrete, if it is preferred.

An important element, of course, in the process of building is the concrete or cement itself. It is burnt down from stone somewhat in the same way as lime, but, of course, is of an entirely different nature. When the cement is to be used, it is mixed with rough sand, generally for ordinary purposes in the proportion of eight pailfuls of sand to one of cement. The two are mixed simply in the ordinary way, water being poured over the sand and cement until they are in a semi-liquid state. When the sand is very sharp and shelly, the concrete can be made in proportion of nine pailfuls of sand to one of cement; while in other cases again, where the sand is of a soft inferior description, one pailful of cement is necessary to seven pailfuls of sand.

CAPITAL is only another name for the savings of society.

Aniline Black.

Aniline black is generated by the action of oxidising agents upon aniline, or the aniline oils of commerce. Its formation is consequently similar to that of other aniline colors. In these operations a molecular condensation takes place, in consequence of the more complex combination into which the atoms of aniline and toluidine enter. A like condensation occurs in the formation of aniline black.

These oxidation products of aniline and its homologues, namely, the aniline colors, are of a basic character. Aniline black is decidedly basic. As to the nitrogen, it either remains—as in magenta—in the new formed compound, or it is partially disengaged as ammonia. The latter reaction occurs in the formation of aniline black, or, as it may be called, nigraniline.

The author used as ingredients muriate of aniline, chlorate of potash, a trace of chloride of copper and water, mixed at common temperatures. The formulæ for the preparation of this color all contain sal ammoniac. The author finds, however, that a color equally fine and pure can be prepared without this addition. The mixture was evaporated at common temperatures in the air in a porcelain capsule and repeatedly remoistened till a dry, water repelling powder of a velvet blackness appeared—a sign that the process was complete. The aniline oil, muriatic acid, and chlorate of potash were used in equal weights, and at the conclusion a number of undecomposed crystals of chlorate of potash were found. No free aniline was detected in the acid liquid, but ammonia was found in its stead. After washing in hot water, the black powder was combustible without residue, giving off when ignited a smell, first of naphthylamine, and afterwards of cyanogen.

The aniline oil employed contained toluidine, and yielded 120·5 per cent of the washed black powder. This large yield, and the circumstance that the color, as fixed upon the tissues, is a deep green and does not become a violet black till after treatment with an alkali, led the author to suppose that it was a base, and contained when green a muriatic acid in combination. This proved to be the case. The dark green body is a muriate of nigraniline (aniline black), the deep violet being the free base.—*Rheinbeck.*

Solubility of Ozone in Water.

L. Carius has made the observation that ozone is, under proper conditions, appreciably absorbed by water, which fact he has communicated to the Chemical Society of Berlin. He recommends for the purpose that the water shall be near its freezing point, and that the vessel containing it shall have but a small neck. If these conditions are observed, and a stream of ozonized oxygen is conducted into it, the water will take on gradually the characteristic smell of ozone, and its presence may afterwards be proven by all the usual reagents.

The method of preparing the gas followed by the author was that of Soret, namely, by the electrolysis of cooled diluted sulphuric acid, using platin iridium poles.

The ozone solution so prepared may be brought upon the lecture table, and used to bring about all the oxidizing experiments usually performed with the gas itself. Several analyses, made by the author, gave the amount of the absorbed ozone at very nearly one half per cent by volume.

The City of New York.

The population is now about one million. Its territorial area covers New York city, twenty-two square miles. It has twenty nine miles of water frontage, 300 miles of paved and 160 miles of unpaved streets. Twenty thousand gas lights nightly burn in the streets and public places, at a public expense of $43 per year for each lamp. There are 350 miles of Croton water pipes and 277 miles of sewers. There are over 2 000 men in the police force and 600 firemen, whose salaries together amount to a round sum of $3,000,000. 3,000 workmen are employed. The city contributed to the support during the past year of 51,466 criminals. It alleviated during the same time, by out door and institutional charity, the sufferings of 195,334 of the sick.

THE brain of a horse seems to entertain but one thought at a time; for this reason continued whipping is out of the question, and only confirms his stubborn resolve. But if you can by any means change the direction of his mind, giving him a new subject to think of, nine times out of ten you will have no further trouble in starting him. As simple a trick as a little pepper, aloes, or the like, thrown back on his tongue, will often succeed in turning attention to the taste in his mouth.

TEXAN RAILWAYS.—Texan railway progress is very rapid. The Central railroad is in working order to Dallas, and will be completed to the Red River by January 1. Large consignments of bar and plate railroad iron have recently been received at Galveston. Eight lines of road are now under construction in northern Texas. Many of these are extensions of Eastern lines, and three are lines in the transcontinental system. Texas, with its internal resources and its immense prairies, is destined to become a great railway state.

PRESERVATION OF IRON BOLTS.—M. Maitrasse-Dupres has introduced a process which may become invaluable in hydraulic works, namely, for the protection and preservation of iron bolts and ties embedded in wooden constructions. This consists simply in lining the bolt hole with a compound of grease and zinc filings, which is found to galvanize the iron, as it were, and so perfectly protect it.

THE Maryland Institute for the Promotion of the Mechanic Arts will hold its twenty-fifth annual exhibition, to commence on October 1st, at Baltimore.

IMPROVED RAILWAY SYSTEM.

The object of this invention is to overcome the disadvantages attending the present mode of supporting railway rails on ties placed at intervals, by providing for them continuous and equalized bearing surfaces, which are yet of a sufficiently elastic nature to relieve the rolling stock of undue wear and tear. To enumerate the objectionable features of the present system would only be to repeat what we have said in former articles, so we will at once proceed to show how it is now proposed to meet them.

Mr. Connelly, the inventor, has devised, with the above end in view, two plans of construction; one consisting mainly in a system of longitudinal wooden sleepers, and the other in a semi-elastic concrete bed. We will first explain the former, which is shown at the lower side of Fig. 1, and, in detail cross section, at A, Fig. 2.

The sleepers are 10 by 12 inches in cross section. The crossties used are of either cast or wrought iron, and are formed with ribs on the under side and end ribs on the upper sides, while their ends are turned down to correspond with the beveled edges of the sleepers. A portion of one of the ties is shown at B, Fig. 3, from which its construction will be seen. The upper rib serves to support the outer edge of the rail clamp, C, and the lower ribs supply an anchorage for the bolts by which the clamp is fastened.

The ties for joints are eight inches in width and the others two inches and a half; and the clamps are made to correspond. Two of the wide and four of the narrow clamps are used for each length of rail (thirty feet), and the joints of the rails on each side of the track are laid on the broad ties alternately; which arrangement is seen in Fig. 1. The wide clamps are made sufficiently high to take the place of a fish bar, as shown in Fig. 3, and the outer one may, at the rail joints, be made heavier and extended up level with the tread of the rail, so as to take the bearing of passing wheels when the ends of the rails are separated by contraction, and, thereby, prevent their being battered down. The sleepers are mortised to receive the ties, which may be spiked to them through the beveled ends if necessary; and between the tie and the the clamps and rail, at *D*, is placed thin wood, gum, or other elastic material. A substantial road bed between the rails, and extending two feet outside, is made of ballast thoroughly tamped with gravel. The entire construction, as described, will readily be understood on inspection of Fig. 2, at A.

The concrete system is represented in the upper portion of Fig. 1, and at E, Fig. 2. A longitudinal bed of concrete, 14 inches square, is laid down, and is covered with what the inventor calls an "elastic boulevard," one inch thick. Coal tar enters into the composition of this covering and gives it the requisite elasticity. This is capped with a wrought or cast iron plate, which has its edges flanged down in such a manner as to secure the boulevard and itself upon the concrete bearing. The road bed is made as in the previous case, and the ties and clamps used are the same as in that. Oak plank is laid under the rail and clamps, and the cap, crosstie, plank, and clamps are bolted together, as shown at E, Fig. 2.

It is claimed that in th's invention the chance of broken rails is reduced to a minimum, while an absolutely smooth and durable road is secured, and the rolling stock preserved from injury.

The inventor states, further, that in the system of longitudinal sleepers a 48 pound rail is fully equivalent, in all respects, to the 67 pound rail now used with the ordinary ties; and he estimates, thereby, to effect a saving in metal of over $1,000 per mile with iron rails, or of over $1,500 per mile when steel is used. The first cost of the concrete system is estimated to be the same as that of the present track, but the economy in its maintenance would, he thinks, give it a great advantage over the latter.

The proprietors of the patents on this invention, which were dated May 14 and June 18, 1873, are J. C. Tilton & Co., of Pittsburgh, Pa., who are desirous that the improvements should go into immediate use, and who will correspond with railroad officials, manufacturers of materials, capitalists, and others who may wish to become interested.

Fig. 1.

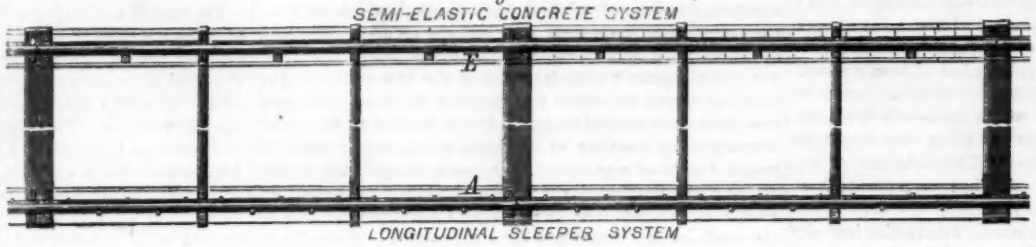


Fig. 2.

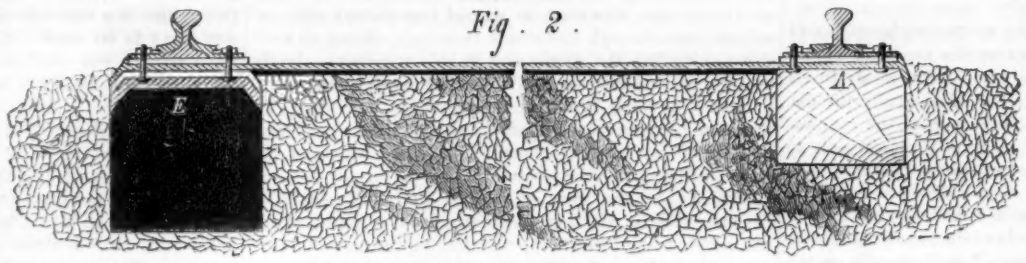
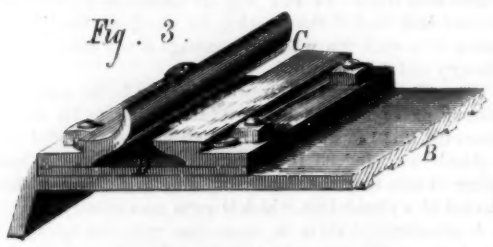


Fig. 3.



CONNELLY'S RAILWAY SYSTEM.

OZONE.—In the *Journal* of the Scottish Meteorological Society for January and April 1872, in addition to the usual records of temperature, pressure, rain, etc., is a report on ozone observations, which appears to be of considerable value. The following conclusions are interesting: "When the air had a pleasant sharpness to the feelings, exercising a stimulating influence on the spirits, the largest quantities of ozone were obtained. On the other hand, when the air was close and seemed to exercise a slightly depressing influence, little, if any, ozone was detected."

IMPROVED REPEATING RIFLE.

In the improved rifle we now illustrate, the skill of the inventor has furnished an example of simplicity, neatness and effectiveness rarely excelled. The piece is a magazine breech loader, and in it the intricacies of construction of such arms have been reduced to so low a point that a long detailed description of its working parts is rendered unnecessary. We may briefly say these parts consist of a sliding breech and cartridge extractor, which is connected by a link with a pivoted breech block, a lever which is moved by the action of the breech block, and a carrier block which is operated by the lever. The gun is also provided with a cartridge gage, by means of which a stop behind the carrier is set so as to accommodate cartridges of various lengths.

In Fig. 1, at A, is shown the opening through which the cartridges are inserted to charge the magazine. It has a spring covering, which yields readily to admit the cartridge and afterwards closes immediately by the recoil. In Fig. 2, at B, is the cartridge gage, which consists of a plate that slides in a shallow groove, and is connected with the stop before alluded to. In using the gage, the cartridge is laid with its point at an engraved line on the mounting, shown in the figure, and with its heel in the groove; the plate is slid forward until it touches the heel, and is then fixed in that position by the screw in its center. Only the length of cartridge gaged can be used unless the gage be altered.

On one side of the front end of the pivoted breech block is a projecting pin, by which the same is lifted up; and it will be observed, on inspecting Figs. 1 and 2, that this can only be done while the hammer is raised so as to clear the projecting tongue on the end of the block. It will further be noticed that by this construction the hammer cannot reach the firing bolt (which is situated under the tongue) while the breech block is raised, and thus all danger of premature discharge is avoided. Still another effect of the construction is that the breech block and all its appendages are securely locked by the hammer when firing. By raising and lowering the breech block, the operations of extracting the discharged shell and loading with a new cartridge, are effected. Upon raising it, the extractor is drawn back and the empty shell withdrawn from the barrel; and upon its attaining its highest point of elevation, its tongue strikes the lever before mentioned, by which the carrier block is raised and made to eject the shell and elevate a full cartridge on line with the barrel. The position thus arrived at is shown in the enlarged view, Fig. 3. Upon swinging down the breech block, the new cartridge is pushed home into the barrel, and the carrier is made to descend in line with the magazine to receive another.

Fig. 1

Fig. 2

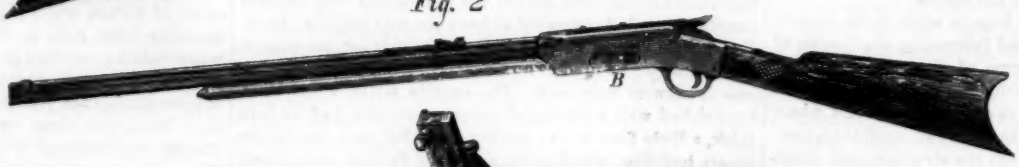
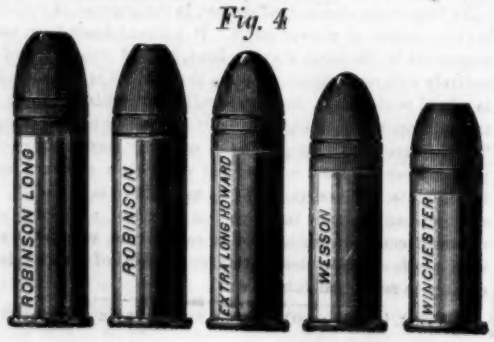


Fig. 3

ROBINSON'S MAGAZINE REPEATING RIFLE.

Fig. 4



In Fig. 4 are shown various samples of projectiles, full size, to the use of which the gun can be adjusted. It will be seen therefrom that the arm is adapted for cartridges of unusual length, and it is claimed that its range and penetration are increased accordingly. Its caliber is $\frac{44}{100}$ in., and loads of this size varying in length from 1¼ to 1⅝ in. can be used.

We may remark that the barrel of this rifle may be separated from the stock by simply removing a pin. The weight of the weapon as manufactured is from 7 to 9 pounds, and its length from 42 to 47 inches—the barrel being from 24 to 28 inches; and it carries from six to eight shots.

Among other advantages claimed for it are its beauty of form, strength, safety and superiority of balance consequent on the perfect proportion of all its parts, and the fact that all its working parts are closed in and protected from injury.

The gun was patented through the Scientific American Patent Agency, April 23, 1872, by Mr. Orvill M. Robinson, a previous invention of whose in the same direction we illustrated at page 127, Vol. XXV. It is manufactured by the Adirondack Fire Arms Co., Plattsburg, N. Y., of whom further information may be obtained.

THE "HEATHEN CHINEE"—The San Francisco *Bulletin* says: A manufacturer of bird cages and other ware in the city, a short time since, thought to enlarge this revenue by substituting Chinese cheap labor for the white workmen he had in his employ. The Mongols did well enough, at $1 a day, for a short time, until they mastered the business, when the whole party resigned and set up for themselves, and are now "bearing" the bird cage market at a fearful rate. The author of this enlargement of their sphere of enterprise is prone to believe that "we are ruined by Chinese cheap labor."

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THE APPRECIATION OF KNOWLEDGE.

It is an old observation that man generally appreciates only that knowledge which he possesses himself, even if this possession is quite limited; and that those branches of knowledge to which he is a total stranger are considered by him as not worthy of the expenditure of his own or any body else's time. We must, of course, make exceptions to some ornamental accomplishments; a man who never danced may come into a ball room, and then appreciate the value of dancing, and wish he could dance; or a young lady without any education whatever may ardently wish she could play the piano and talk French; but such a kind of appreciation proceeds not always from any love to the knowledge itself, but often from the reasonable and natural desire to make one's self agreeable and entertaining, or, what is worse, often simply from vanity and the selfish desire to shine and eclipse others.

It is this total ignorance of everything relating to the science of the present day, of those educated in our old fashioned exclusively literary colleges, which is the chief cause of the opposition to the introduction of scientific courses in our higher educational institutions. The knowledge of the classical languages and their literature, even when it is only limted, of course increases its appreciation more and more; and if the student, by an incomplete *curriculum*, is kept exclusively in this path, he must of course become one-sided; the result is seen in the opposition of the present day, found among many professors and students, to the innovation of devoting to the scientific course as much time as to the classics. It is perhaps little known that, 300 years ago, there existed as much opposition against a reform then introduced into the classical education as there is now manifested against the modern reform. The reform then introduced was the study of the Greek language and literature. The whole scientific world was then under the tuition of the scholastic lecturers in Latin, who, under pretence of teaching the philosophy of Aristotle, taught nothing but the rubbish under which the philosophy of Pythagoras and Plato were buried. When, after the overthrow of Constantinople in 1453, by the Moslems, the learned Christian Greeks had been driven to the cities of the west, and diffused the well merited admiration for that language and literature, the scholastics and Roman Catholic theologians, comfortably seated in their universities and pulpits, opposed vehemently the attention which was then commenced to be paid to Greek. Their opposition was bitter and most violent; the Christian faith, they said, was in danger. The Greek classics would undermine Christian Roman theology. The established and well tried mode of educational training were to be superseded by worthless empirical schemes. The humanities would supersede divinity, and society would be endangered by such a change, etc.

The changes, at last established in the system of study, came then as now, not from inside appreciation, but from outside pressure. Hamilton says: "The awakened enthusiasm for classic studies did not originate in the universities; it was only after a strenuous opposition from these bodies that ancient Greek literature achieved at last its recognition as an element of academical instruction." The new philosophy, so called, was considered a fifth wheel to a wagon, abominated as a novelty that threw the ancient Latin learning into discredit, diverted the studious from the universities, emptied the schools of the *magistri* and the *bursæ* of the colleges over which they presided, and rendered contemptible the once honored distinction of a degree. Greek in particular and polite letters in general were branded as heretical, and while the academical youth hailed the first lecturers on ancient Greek literature in the universities as messengers from heaven, the academical veterans prosecuted these intruders as preachers of perversion, and winnowers of "the devil's chaff," etc.

It is curious to observe the similarity of the objections made against the educational reform of that time, and those made in our time against the introduction of scientific training. It is also now asserted by the ultra orthodox veterans that religion is in danger, that science will beget infidelity, etc.

In the meantime, science manifests so powerfully its influence on our present social condition that opposition to its study is utterly useless. Every thoughtful man is reminded almost every minute of his life of what comforts he owes to scientific research, discovery and invention. We close with a quotation of George Gore, of Birmingham, England, from an article on "The Practical Importance of Scientific Education" He says: "Every man who eats his food with an electro-plated fork is indebted for the use of that article, not only to the labors of those inventors who developed the steam engine, by means of which the metal is rolled and stamped into forks, but also to Volta, Davy, Daniell and others who produced the voltaic battery, to Gay Lussac, who discovered cyanide of potassium, and to the various inventors and practical men who applied all those means to produce the final result." And this is only a single illustration out of scores which can be easily given.

PROTECTION FROM LIGHTNING.

The importance of metallic rods as a means of protection against lightning was well illustrated during a thunderstorm at Baltimore, on the 20th ult., when an electric discharge fell upon the rod of the Washington Monument. This structure has an attitude of 185 feet, stands upon high ground in an open square, and forms a conspicuous point for the convergence of electricity. The monument was protected by a common lightning rod, put up apparently in a bungling, imperfect manner, but it unquestionably saved the structure from serious damage. The Baltimore *Sun* says that "investigation shows that the damage to the statue and monument was very slight indeed when compared with the damage to the lightning rod, and infinitesimally so when compared with the damage that would necessarily have resulted if the rod had not been there. A careful examination developed the fact that the rod received the whole charge and passed it safely to a bad connection, five feet from the point at which a lateral explosion occurred, knocking some small fragments out of the statue; from that on, it followed the rod, exploding in its way wherever inferior connections obstructed its passage, blacking the top of the base between the shaft and the outer edge as thoroughly as though a large quantity of powder had been exploded upon its surface. From there to the earth, the lightning passed without further explosion until arriving at the terminus of the rod, at which point the flag pavement was torn up and broken into fragments. It then seized upon the iron railing surrounding the base of the monument, over which it passed, fusing it where it first came in contact with the metal. Wherever the connection was good in the lightning rod, no damage was done."

In almost every example where buildings having rods upon them are damaged, it will be found that the connections or terminals of the rods are defective. One of the chief defects of lightning rods, as they are ordinarily put up, is in the ground terminals. The lightning-rod-man covers the house with neat looking rods and points, sticks the lower end four or five feet into the ground, pronounces the job a good one, receives his money and departs. But a rod thus left is almost as unsafe as it would be if its lower end were enclosed in a glass bottle and rested on the ground.

Ordinary earth is an exceedingly poor conductor of electricity as compared with iron; hence, in order to effect the safe discharge of electricity from an iron rod into the earth, the bottom of the rod should be provided with a large conducting surface, so that the electricity may be diffused and pass into the earth at many points simultaneously. The explosion at the pavement, in the example of the Baltimore monument, shows that the rod there employed was sadly deficient in the area of its ground terminal.

The necessary area of underground conducting surface for a lightning rod may be obtained in a variety of ways: (1.) Extend the rod itself for a considerable distance underground, away from the building. (2.) Connect the lower end of the rod with an iron pipe which extends in like manner underground. (3) Provide a trench and supply it with good charcoal well packed, and imbed the rod, for some distance from the building, in the charcoal.

As an electrical conductor, well burned charcoal ranks next to the metals. Metallic ores come next to charcoal. Water and moist earth, which are so frequently recommended as terminals for lightning rods, are among the poorest of conductors.

One of the best protected dwellings that we have heard of is that of Mr. John Knox Smith, an intelligent English merchant residing at Singapore. His country house is built on a prominence, upon a bed of iron ore, with which the house lightning rods are made to communicate. The lower ends of the rods thus have a very extensive conducting surface, and the protection afforded is considered perfect. Thunderstorms and lightning strokes are very frequent, but the house has never been injured.

A PETROLEUM FIRE.

A great conflagration of petroleum occurred at Hunter's Point, opposite New York city, during the forenoon of the 30th ult. Over thirty-five thousand barrels of crude oil and thirteen thousand barrels of refined oil were consumed, together with many valuable buildings, tanks, docks, and several vessels. Property to the value of over one million dollars was consumed. The fire spread over an area of ten acres, and lasted for twenty-four hours, emitting an immense quantity of flame and smoke, which rose in a column of great hight, visible in all directions for twenty miles or more.

The Standard Oil Works, one of the largest refining and storing concerns in this vicinity, were totally destroyed. The fire broke out in a canal boat which was being loaded at the dock in front of the Standard premises, and is alleged to have been caused by the careless throwing down of a match by a workman, after lighting his pipe. The spread of the flames was so rapid, owing to the explosions of the oil barrels, that the firemen and workmen were compelled to keep at a distance, and were able to do but little in arresting the fire.

Large flocks of tame pigeons were observed to approach and whirl as though maddened around the huge column of smoke, and then dart suddenly into the midst of the flames and perish.

During the progress of the flames, some of the burning vessels were carried by the tide into the East river and floated northward. One of them, burning at a furious rate, was thus carried through the narrow channel between Blackwell's Island and Astoria, through the fearful pass of Hell Gate, beyond Ward's Island to Port Morris, a distance of five miles, where it approached the extensive docks and storehouses at that place, threatening the whole with destruction. No escape seemed possible, as no means for preventing the collision were at the command of the inhabitants. Slowly the burning monster came on, belching forth horrible flames and smoke. At the last moment, when all hope of saving the Port Morris warehouses was abandoned, a United States steamer was observed to run in under the smoke, into the very middle of the burning vessel. Running in and backing out quickly several times, the officers of the steamer finally succeeded in casting an anchor and chain upon the flaming hulk, by which it was towed out into the stream, and Port Morris was saved. The steamer proved to be the United States revenue cutter *Bronx*, and her commander and men are entitled to great credit for the skill and courage they so successfully displayed.

We are glad to be able to state that the extensive Astra oil establishment of Charles Pratt, which was illustrated so fully in our supplement a few weeks ago, escaped all injury. The Pratt works are located next south of the Standard works, and only escaped by a sudden shift of the wind after the fire broke out.

The application of water for the purpose of extinguishing petroleum fires, appears in this, as in other examples, to have been of little service. The water simply buoys the flaming oil, and enables it to run off in different directions, carrying destruction in its course. It is evident that a more effective extinguisher than water must be brought into use before we can hope to prevent these terrible conflagrations. Whoever can discover an effectual agent for this purpose or find out some simple way of rendering the oils uninflammable while in transit or storage, will confer a great benefit upon the country.

A RAILWAY ACCIDENT EXPLAINED.

By a recent accident on the New York and Oswego Midland Railway, a freight train was completely wrecked and much valuable property destroyed, but no lives were lost. The accident took place near Oneida, N. Y., while the train was running at a speed of from twenty to twenty-five miles an hour on a down grade. The train consisted of the locomotive and tender, two box cars, then two empty platform cars, followed by twelve or fourteen cars loaded with coal and other freight. The brakeman, a new hand, states that according to orders on down grades, he set the brakes on the box cars in front, and had just put his hand on the brake of the first platform car when he saw that the second platform car was off the track. In a moment more it was thrown athwart the track, a general crash ensued, and he jumped for his life.

Among the reasons assigned for the accident was the stereotyped one, "broken rail"; also slipping of a wheel on its axle; also dropping down of a brake. But Mr. Alfred Hawley, superintendent of the Oneida Community machine shop, who made a careful examination of the track and remains of the wreck on purpose to ascertain the correctness of these alleged reasons, gives a different report. He found the rails and road bed in perfect order, and no indications of a dropped brake or slipped wheel. "What then was the cause of the disaster? What caused the middle portion of a train to leave the track on a straight, level, well lined, well ballasted portion of the road? We are convinced, says a correspondent of the Oneida *Circular*," that the accident was caused by an improper application of the brakes to the forward part of the train when running at a high speed." He thinks that the checking of the front part of the train caused the heavy rear cars to crush against the light platform cars and lift them from the track; and with this opinion, probably most railway people will agree. The same correspondent takes occasion to observe that many of our railway accidents are due to the incompetency, carelessness or ignorance of railway employees; and with this view, almost everybody will coincide.

THE INTERNATIONAL PRISON CONGRESS.

An international congress is now in session in London, composed of representatives from all civilized countries, for the purpose of considering the questions of the repression and prevention of crime and the care of the criminal. The delegates number many distinguished persons, many of whom have made the subject of prison reform a life study.

The United States is represented by Rev. Dr. Washburne, Rev. C. L. Brace, General Pillsbury and others, of New York, Hon. Mr. Chandler of Pennsylvania, Dr. Wines and Governor Haynes of New Jersey, and Mrs. Julia Ward Howe of Boston. Among the members from the countries of Europe are Count Sollohub, director of a large prison in Russia, Count Scalia, Director of Prisons in Italy, Privy-Councillor Steinmann of Germany, Professor Marquardsen of Erlangen, Baron Von Holtzendorff, the great authority on criminal law in Prussia, and Miss Carpenter, one of the most celebrated philanthropists in England.

Various questions relating to the subject of reform and punishment have been discussed at considerable length. Corporal punishment, and especially the use of the "cat," met with hearty condemnation from the American and continental authorities, but the English, with some exceptions, advocated it as a means of discipline. The Austrian, Bavarian, and Swiss delegates stated that corporal punishment had been totally abolished in their respective countries with the best effect. The argument on the British side took the ground that the lash was a necessary requital for crimes of brutality, such as wife beating and garrotting. The latter species of robbery, which had become alarmingly prevalent in London, had almost disappeared since its perpetrators were punished by severe castigations.

The "treadmill," a most useless and degrading penance, was found to be still in use in British prisons, although it has been abolished for over forty five years in those of America. The continental delegates affirm that it is unknown in their countries. Several English members were eloquent in its denunciation. Colonel Colvill, a prison director, states that he had been obliged to employ the mill on an average of 600 prisoners yearly for eighteen years past, and that he had never known a human being to be benefited by it. On the contrary, its only effect was to harden and depress.

The question of the prevention of crime was also brought up, several members making reports of the labors of societies for that purpose. Reformatories of different types were discussed, the general conclusion being that the "Family Reform School" was superior in every way to the "congregated" system.

It was considered that the best mode of aiding discharged prisoners was by obtaining for them co-operative employment. Thirty-four aid societies are in existence in England, which have yearly provided for about 5,500 discharged convicts. Regarding the rehabilitation of the latter, the system of placing them under the surveillance of the police was condemned.

Mr. Sergeant Cox, in reference to the repression of criminal capitalists, stated that in his opinion the receiver of stolen property should receive double the punishment imposed upon the thief.

The industrial school system of New York was fully explained, and the value of the institution shown by the fact that 2 200 children had been sent to honest employment in the West. Compulsory education was defended and generally considered a valuable auxiliary in the prevention of crime. Baron Von Holtzendorff stated that, by the law of Germany, no child could come before a magistrate for crime until above the age of twelve, but all cases of crime under that age were reported to the schoolmasters, who punished. In that country, also, the children of prisoners who are without friends are taken care of by the State in the same manner as orphans. In the United States, it is customary to consider a child as a "ward of the State," and the prisoner, when his sentence has been served, can only regain control and possession by order of court.

A correspondent of the New York *Times* says that "the British delegates were amazed to hear from General Pillsbury, of Albany, that he had carried on various prisons not only without expense to the public, but saving a handsome surplus for permanent purposes; and that, in his experience, teaching a man a trade saved him from repetition of crime. Similar experiences, from Massachusetts, of self supporting prisons, were detailed, and produced a deep impression. Count Solloherb, director of a large prison in Moscow, stated that in three months he could give a man a trade; that the prisoner became better under it, and out of the thousands he sent forth annually, less than one per cent repeated their offenses, or came under the law again."

The results of the deliberations of this congress of philanthropists, composed of men and women who are thoroughly familiar with the darkest side of life and with the statistics of crime in both the old and new worlds, cannot but be of the greatest importance. By this interchange of views, the many and grievous faults of our present system of prisons and reformatories, which in a great measure are due to adherence to old and obsolete ideas, may be clearly seen and remedied; while valuable improvements and innovations will be suggested through the contrast of our methods of repression and prevention of crime with those adopted by other nations.

NEWSPAPER BENEVOLENCE.

Among the benevolent enterprises lately put in motion in New York was a subscription to pay the expenses of giving the poor children a holiday excursion. This was set on foot by the New York *Times*, and the holidays have been very properly designated the "Times excursions." Nearly twenty thousand dollars have been contributed, and perhaps forty thousand ragged youngsters have enjoyed the luxury of a steamboat ride, a romp in the woods, and a good time generally, with refreshments.

One or two of these excursions was exclusively devoted to poor mothers and their young children. Another notable excursion was that of the newsboys, of which the *Times* says: "The party was composed entirely of newsboys and bootblacks, than whom there is not a rougher and more irrepressible class in New York. Large posters announced the picnic and called for a thousand boys. When the manager of our picnics reached the *Times* office at 6¼ o'clock A. M., he found it besieged by boys clamoring for tickets. The crowd was quickly transferred by him to the City Hall Park, where the smaller boys were all picked out and badges pinned on their jackets, if they had any, but on their shirts as a general thing. Shortly before 7½, the superintendents of the various newsboys' lodging houses with their contingents marched into the Park; and till the order for the column to march was given, a scene went on such as perhaps has never before been witnessed in New York or any other city."

Hundreds of little ragged urchins, few of them possessing shoes and stockings and many having nothing to protect their close cropped heads from the sun, were dashing about in a high state of glee if they had secured a badge, or in a state of great anxiety if they had not yet done so. Those who were too big to go would beg and pray for a ticket. The boys danced, stood on their heads, turned somersaults from pure exuberance of spirits, and many a bit of roguish satire was sent at those who could not be taken. The steps of the City Hall were crowded with interested spectators of the scene; in fact the whole of the south side of the Park was crowded. At last the boys were formed in line, in three separate divisions, wearing red, white, and blue badges respectively. At 8 o'clock the band from Governor's Island entered the Park, and taking up their position, the order to march to the steamboat was given. The scene at this moment was really exciting. As division after division, each headed by its own banner, left the Park, the crowd cheered and waved their handkerchiefs, ladies appeared at the windows of the Astor House, every store on Broadway and Park Row was emptied in a moment, and the sidewalks were thronged. As the little fellows passed the *Times* office, they sent up cheer after cheer. Every moment the number of spectators increased, so that in Chatham street and up East Broadway the little army of ragamuffins was escorted by a crowd as large as that which attends the Seventh Regiment on dress parade days. The boys were carried to a fine grove on Long Island Sound, where they had a day of most hearty enjoyment.

WAVE POWER PROPELLERS.

Some fifteen or twenty years ago, we published in the SCIENTIFIC AMERICAN the drawings of a self propelling vessel, in which the sides of the ship were provided with hinged propelling blades, so arranged that by the roll of the boat the blades would alternately open and close, giving the vessel a forward push at every lurch.

This was a novel idea at the time, but it involved the attachment of considerable mechanism to the outside of the vessel, which, under the rough usage of the billows, would be likely to breakage or disorder. It is obvious that the use of ordinary masts and sails is a much better plan of propulsion. The flapping blade system, we observe, has lately been revived, and notices thereof are circulating through the press. It makes a good newspaper item, but has no other value.

WATER VAPOR NOT VESICULAR.

A recent experiment by T. Plateau disproves the commonly received theory respecting the vesicular nature of aqueous vapor. He provided a column of water, contained in a glass tube and held therein by atmospheric pressure, the bottom of the water column being exposed; small air bubbles, on being brought from the point of a small tube into contact with the exposed water surface, immediately rose through the water column. If water vapor is vesicular, it should do the same. But experiment shows that it will not. On directing a current of ascending vapor from boiling water against the bottom of the water column, no appearance of rising vesicles through the water could be detected.

INCLINED RAILWAY IN SAN FRANCISCO.

The steep elevation of the lands immediately adjoining the city of San Francisco and the desirability of providing convenient access thereto have induced some enterprising individuals to attempt the construction of an inclined railway. The incline will be 2,800 feet in length, traversed by cars drawn by steel wire ropes and stationary engines. The cars are to be provided with clutches whereby the rope may be grasped or released at the will of the conductor. At the top of the incline, the cars are delivered over to the horse railway.

Wood Carpeting.

A correspondent recently suggested that a substitute for matting for covering floors, cheap, durable, and cleanly, was desirable. The wood carpeting, made and laid by the National Wood Manufacturing Company, 942 Broadway, New York, is the best, cheapest, and handsomest material for halls, dining rooms, and kitchens that we have ever used. The expense is not so much as that of carpeting, and but little more than that of matting; and when properly laid, it will last a number of years. We have substituted it for matting in a summer residence, and find that it possesses all the advantages of a solid hard wood floor.

THE Fourth Annual Fair of the Carroll County, Md., Agricultural Society is to be opened at Westminster, Md., on September 30, and will continue till October 5. Among the premiums to be awarded are several subscriptionr to the SCIENTIFIC AMERICAN, rewards which are always acceptable to the recipients and welcome to their homes and families.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

CINCINNATI, Ohio., July, 1872.

Cincinnati and its approaches. The great suspension bridge of Roebling. The iron railway bridge over the Ohio. The Danks puddling furnaces; interesting particulars concerning their operation. The Cincinnati water and gas works.

The route to Cincinnati *vid* the "Panhandle" line of railroad, although not presenting as many beautiful landscapes and such a panorama of picturesque scenery as the Pennsylvania railroad in crossing the Alleghanies, exhibits to the traveler not a few exceptionally fine views in the neighborhood of Pittsburgh. That of the confluence of the Alleghany and the Monongahela rivers to form the Ohio, and the long stretch of the latter river that can be seen just after leaving Pittsburgh, are especially attractive, possessing such beauty, when seen by the light of a sun just setting among gorgeously colored clouds in the west and throwing no less beautiful though quieter colors over the eastern clouds and along the further river bank, that those who have been fortunate enough to witness it will long hold it in remembrance.

En route, we pass through the city of Columbus, Ohio, a pleasant town with wide streets, having some fine public and many fine private buildings. The capitol would be a noble structure except for what seemed to us its very ugly dome. The city hall is a very neat building. There is not very much manufacturing done here, and we only remained long enough to see something of the city and to take the next train for Cincinnati.

This latter city can hardly claim to be a manufacturing place, although its manufactures, in the aggregate, employ a considerable amount of capital. The business of manufacturing furniture is becoming its leading branch of industry. The comparative low price of walnut and other kinds of wood used in the business enables it to reach profitably for its market as far east as Pittsburgh and all over the West and Southwest. Some of the furniture made here is extremely neat in design, well made and of beautiful finish, fully equal to any thing made east of the Alleghanies. Prices are not very far from New York figures.

THE GREAT SUSPENSION BRIDGE AT CINCINNATI.

In Cincinnati, we were particularly interested in the great bridges over the Ohio river and in the now well known Danks' revolving puddling furnace.

Entering the city by rail from Columbus, one of the first and most striking objects that catches the eye is the great suspension bridge stretching across the river to Covington, Kentucky. This immense structure has a greater span than any bridge yet built in the world.

It was built by the late John A. Roebling, the builder of the two suspension bridges at Pittsburgh, and of the almost equally wonderful structure at Niagara Falls. Considering the time at which it was designed and the difficulties with which he contended, its successful completion justly entitles its designer to be considered one of the boldest and most talented engineers that the world has yet known. At first view, the bridge impresses the observer by its magnitude, as well as by the neatness of its general design, and by the graceful sweep of the great wire cables which support the roadway; but a second visit is even more impressive than the first, and, after studying it from different standpoints, and after walking across it several times, one feels that, after all, the mind was quite incapable, at first sight, of appreciating this great engineering wonder of our age, or of understanding what difficulties are met in the general plans, to say nothing of those of detail, by the engineer who attempts to sustain a bridge like this between piers separated by a distance of nearly a quarter of a mile. Those who are now watching the progress of the East River bridge at New York—which was designed by the same great engineer, in the light of all the experience gained by a life time devoted to such work, and the construction of which is proceeding under the directions of a son who profits by his own special scientific and practical training as well as by his father's experience and teaching—can hardly appreciate the talent, the hard work and the mental anxiety and activity that must have been demanded of the engineer during the progress of the Cincinnati bridge, which has but about a hundred feet less span.

THE IRON RAILWAY BRIDGE.

Further up the stream is the great iron railroad bridge built by the Keystone Bridge Company. At the channel span, the bridge is 400 feet from pier to pier, and, were it not so near the great suspension bridge, it would at once awaken in the spectator the greatest interest and admiration. It is a beautifully proportioned and well made bridge. The members carrying a compressive stress are formed of the peculiarly strong and readily constructed built columns used by some of our leading constructors; and the tension members are rods and links with ends upset, to secure full strength at what are usually their weakest parts, and to distribute the extension of the metal throughout the whole length of the piece. The importance of this last advantage is too seldom understood and attended to by constructing engineers. It is a point of special consequence, in mechanical engineering and wherever structures are exposed to sudden strains and heavy shocks.

THE DANKS PUDDLING FURNACES.

A part of a day was spent at the mill of the Cincinnati Railway Iron Works Company, examining the Danks puddling furnaces and watching their operation. These furnaces have attracted the attention of iron manufacturers both here and abroad, for, although by no means the first "rotary puddlers," they are the first whose operations has been suffi-

ciently satisfactory to induce proprietors to substitute them wholly for the old furnaces in even a single mill. The Danks patent is upon details; but the inventor is certainly entitled to much credit for skillfully proportioning them, and even more for his perseverance and tact in overcoming those difficulties that usually impede, for many years, the progress of the most meritorious inventions.

The ordinary process of puddling consists in melting cast iron upon the hearth of a reverberatory furnace and stirring it until the carbon has been burned out, and other impurities have passed into a slag; and malleable or wrought iron then remains. Many attempts have been made to substitute machine for manual labor in the process, but none have been hitherto successful, and, all over the civilized world, puddling is done by the same old process; and the severity of the labor, together with the intensity of the heat to which the workman is exposed, makes the life of the puddler a short one and the process comparatively expensive.

The Danks puddling furnace has an ordinary furnace grate, but, instead of the large chamber of the reverberatory furnace, a barrel shaped vessel receives the charge of pig metal, and through this the flame passes to the chimney. The metal once melted, the barrel is caused to revolve by steam power, and as the fluid metal flows around the interior, the carbon which it contains and the accompanying silicon are oxidized by contact with the passing oxygen in the furnace gases, and with that of the iron ore with which the barrel is lined. Gradually it loses its fluidity, becomes viscous and finally pongy, and is then malleable iron. One end of the barrel is movable, and that being removed, the great "ball" of spongy iron, weighing 600 to 700 pounds, several times the weight of an ordinary puddle ball, is taken out, carried, by tongs suspended from an overhead railroad, to the squeezers, where it is rolled and compressed into a billet of quite compact iron, and thence to the "muck train" of rolls in which it is given the shape of a long rough looking bar, which only requires additional rolling to convert it into such "merchant bar" as we see in the market. The process was a very interesting one to us, and the contrast between this and the ordinary method, so far as the comfort of the workman is concerned, was very marked and very gratifying. So satisfactorily have these furnaces done their work here that they have displaced all of the old furnaces in these works. English iron masters have considered the improvement so important and desirable that they some time since sent a commission to this country to determine the real value of this furnace.

The commission brought over many tons of the worst, as well as of some of the best, British irons and puddled them here. Their report is one that will interest and please every friend of American manufacturing industry. We saw very good iron which had been made from Yorkshire pig, and from even worse Welsh cast iron; and, during our visit, the furnaces were working with *stove scrap*, which is, probably, generally about as poorly adapted for the purpose as any iron that can be found; judging from the appearance of the bars produced, it made a good iron. Whether this particular furnace will ever become generally used is uncertain, and even a matter of little consequence to the world; but it is eminently desirable that, in some form, a machine may perform this very simple and yet essential detail in the process of iron making, and, at the same time, reduce its cost and relieve the workman from one of the severest tasks known in the arts.

THE CINCINNATI WATER AND GAS WORKS.

After visiting the water works, where we found five steam engines engaged in supplying the city with water, and where we were especially interested in the working of the largest—a great machine, 100 inches in diameter of cylinder and of 12 feet stroke of piston—we accepted the invitation of Mr. E. M. Breese, the engineer of the city gas works, and, under his guidance, examined that great establishment very minutely. Space will not, however, allow of a description of this or of other interesting establishments which may be found at Cincinnati. Some idea of the magnitude of the city itself is afforded by the facts, learned at the gas works, that they consume annually about 1,250,000 bushels of coal, making 700,000,000 of cubic feet of gas. Such a quantity of coal would warm, for the winter, the houses of about 6 000 New York mechanics, and the volume of gas made annually is perhaps four times as great as that of the 6,000 houses taken together. R. H. T.

SLICING APPLES.

The wholesomeness of the apple as an article of food is not as widely known as it deserves to be. The fruit not only contains large quantities of nutritive matter, but has valuable antiseptic qualities which exercise the most beneficial effects on the system. In order to prepare apples so as to have them available for use at any time, a correspondent suggests the following method: A hole of about the size of an ordinary apple is cut in a block of wood. On the under side of the orifice, seven shoe knives are arranged, edges up, in such a manner that the middle blade is the lowest, the the pair on its either side on a higher plane, the next pair higher and so on—so that the edges form a curve. The knives are also inclined so that the edges are nearer together than the backs. A follower is fitted into the curve thus made, and is attached to the block of wood by a hinge on one of its sides; to the other, a handle is affixed. To make the plan clear, we should judge that the instrument, as described by our correspondent, resembles a lemon squeezer, with knife blades substituted for the perforated cup in which the lemon is usually placed. The apple, being placed in the orifice, is pressed down by the follower upon the knife edges. It is thus cut into slices which fall through the openings between the blades. In this manner, we are informed, a bushel may be sliced in two or three minutes. The slices are then spread upon a grass plat and "hayed" in the sun—covering them or raking them together at night. When thoroughly dried they may be stored away, when they will keep without spoiling for any length of time.

RECIPES AND EXPERIMENTS.

The following recipes and experiments have not been practically tested by the editor of the SCIENTIFIC AMERICAN, but are published for the benefit of readers who may desire to try them. The editor would be glad to be informed of the results of such trials.

BLEACHING FEATHERS.—First clean from greasy matter, then place the feathers in a dilute solution of bichromate of potassa to which a small quantity of nitric acid has been added. The greenish deposit of chromic sesquioxide which ensues may be removed by weak sulphurous acid, when the feathers will be left perfectly white.

RENDERING CLOTH WATERPROOF.—Put half a pound of sugar of lead and a like quantity of powdered alum into a bucket of soft water. Stir until clear and pour off into another bucket—into which place the cloth or garment. Soak for twenty four hours and hang up to dry without wringing. This process is said to be very effective.

FILTER FOR CISTERN WATER.—Perforate the bottom of a wooden box with a number of small holes. Place inside a piece of flannel, cover with coarsely powdered charcoal, over this, coarse river sand, and on top of this, small pieces sandstone.

ZINC WASH FOR ROOMS.—Mix oxide of zinc with common size and apply it with a brush, like lime whitewash to the ceiling of a room. After this, apply a wash, in the same manner, of the chloride of zinc, which will combine with the oxide and form a smooth cement with a shining surface.

HARDENING WOOD FOR PULLEYS.—After a wooden pulley is turned and rubbed smooth, boil it for about eight minutes in olive oil, then allow it to dry, after which it will ultimately become almost as hard as copper.

TO CLEANSE WOODEN FLOORS.—The dirtiest of floors may be rendered beautifully clean by the following process: First scrub with sand, then rub with a lye of caustic soda, using a stiff brush, and rinse off with warm water. Just before the floor is dry, moisten with dilute hydrochloric acid and then with a thin paste of bleaching powder (hypochlorite of lime); let this remain over night and wash in the morning.

MUCILAGE.—Glue, water and three per cent of nitric acid adheres well to metallic surfaces.

PRESERVING STUFFED ANIMALS WITHOUT ARSENIC.—Rub the flesh side of the skin with a composition of 1 lb. tobacco ashes, ½ lb. alum, 2 lbs. dry slaked lime.

CLEANING OIL PAINT.—Whiting is better than soap. Use warm water and a piece of soft flannel. Afterwards wash clean and rub dry with chamois.

MAKING CITRIC ACID.—Treat fresh lemon juice with powdered chalk until all the acid is neutralized. Citrate of lime will be precipitated, which wash and then decompose by means of diluted sulphuric acid. A precipitate of sulphate of lime will then be formed while the citric acid dissolves. Filter, and the citric acid will deposit itself in crystals when the concentrated liquid cools.

VERMILION PAINT.—The tendency of paint made from vermilion (cinnabar or sulphide of mercury), when mixed with white lead, to turn black or brown in a short time may be obviated by mixing with the dry paint, before adding the oil, one eighth of its weight of flowers of sulphur.

CLEANING GLASS.—The lenses of spectacles or spy glasses that have come scratched or dimmed by age may be cleaned with hydrofluoric acid diluted with four or five times its volume of water. The solution should be dropped on a wad of cotton, and thoroughly rubbed on the glass which should afterwards be well washed in clear water. Great care must be exercised in handling this acid, as it eats quickly into the flesh, often producing painful and obstinate sores.

PAINTING ZINC.—Oil paint may be made to adhere to sheet zinc by coating the latter with a composition of one part nitrate of copper, one part chloride of copper and one of sal ammoniac, dissolved in sixty-four parts of water; add to the solution one part hydrochloric acid. This should be left from twelve to twenty-four hours to dry. It acts also as a protection to the metal against atmospheric influences.

TO RENDER CORKS OR STOPPERS AIR TIGHT.—This can be accomplished by covering with a cement composed of red lead or finely powdered litharge mixed with undiluted glycerin.

What Fifty Thousand Dollars Will Buy.

The following advertisement appears in the daily papers, and we give it publicity, free of charge, for the benefit of all who have fifty thousand dollars to invest in perpetual motions:—

$50,000 WILL BUY ONE-FOURTH INTEREST IN A NEW AND wonderful invention, a self-acting Engine of great power, which I get from vacuum or air cylinder, attached to an endless chain or band, rising up through a tank or column of water from 10 to 900 feet high or more if desired. I shall give a full explanation and give it away to all the world, and trust to its sense of justice for my recompense, if I do not find some one to take an interest in it. Address J. W. SHIVELY, inventor, box 571 Saratoga Springs Post Office, N. Y.

This beats Niagara Falls, where we have a perpetual motion, in the form of a column of water three quarters of a mile wide and several feet thick, falling 160 feet, and presenting a force of millions of horse power. Would it not be cheaper for the inventor to avail himself of this natural column of water, and in it test the practicability of his machine, before going to the expense of erecting a special column 500 feet high, as he suggests?

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed four Lines, One Dollar and a Half per Line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin. $4 00 a year. Advertisements 17c. a line.

Coal at wholesale. If in need, write L. Tower, 71 Broadway, N. Y.

I will purchase part or entire interest in a real practical patented invention. Will be at office of Samuel F. Bartol, 221 Pear Street, New York city, August 9th and 10th.

Wanted—Small Rotary Engine, ½ H. P. or less. D. C. Pierce Portage, Kal. Co., Mich.

Machinery Paint, all shades. Will dry with a fine gloss as soon as put on. $1 to $1.50 per gal. New York City Oil Company, Sole Agents, 116 Maiden Lane.

For Sale Cheap—A quantity of 18 gauge iron plates, half inch wide, one inch long, with round ends and punched with a 1-16th inch hole at each end. Also, a lot of small leather scraps. F C. Beach & Co., 131 & 133 Duane Street, New York.

Sweetser's Blacking and Brush Holder—illustrated in Sci. American, May 18, 1872. Best thing for Stove or Shoe Blacking. Needed in every household. Rights for sale. E. H. Sweetser, Box 317, Salem, Mass.

State Rights for Sale on improved Wardrobe-Bureau and Writing Desk combined. Patented June 11, 1872. Address John H. F. Lehmann, 62 Hester Street, New York city.

Hoisting, Pumping, and Mining Engines, from 5 to 40 H.P. J. S. Mundy, No. 7 R. R. Avenue, Newark, N. J.

Wanted—A Good Second Hand Box Board or Strait Stave Machine. F. R. Smith, Bennington, Vermont.

New Pat. Perforated Metallic Graining Tools, do first class work, in less than half the usual time—make every man a first class Grainer. Address J. J. Callow, Cleveland, Ohio.

Wanted—A Party to Manufacture, on royalty, Patent Self-acting Horse Holders. Those having facilities for making Carriage hardware preferred. Address Abm. Quinn, 280 Marcy Av., Brooklyn, L. I.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

Lenoir Gas Engine—Wanted, the address of any agent in this country of the Lenoir Gas Engine, or of any person who has one imported within two or three years. Address, F. R., Box 488, Newport, R. I.

Platina Plating—Alb. Lovie, 729 N. 3d St., Philadelphia, Pa.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company foot East 9th Street, New York—1202 N. 2d Street, St. Louis.

Gear Wheels, for Models; also Springs, Screws, Brass Tube, Sheet Brass, Steel, &c. Illustrated Price List free by mail. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Brick and Mortar Elevator and Distributor—Patent for Sale. See description in SCI. AMERICAN, July 20, 1872. T. Shanks, Lombard and Sharp Streets, Baltimore, Md.

The Berryman Manf. Co. make a specialty of the economical feeding and safety in working Steam Boilers. Address I. B. Davis & Co. Hartford, Conn.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co., Hartford, Conn.

Wanted—Melter. Permanent situation, at good wages, to a good, experienced Iron Melter. Address C., Iron Founder, Cleveland, O.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. B. Andrews & Bro. 414 Water st., N. Y.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20 1869. 64 Nassau st., New York.

It is better to purchase one of the American Twist Drill Company's Celebrated Patent Emery Grinders than to wish you had.

Flouring Mill near St. Louis, Mo., for Sale. See back page.

State Rights on improved Cigar Moulds for Sale. Patented June 25, 1872. Inquire of Isaac Guthman, Morrison, White Side Co., Ill.

For Machinists' Tools and Supplies of every description, address Kelly, Howell & Ludwig, 917 Market Street, Philadelphia, Pa.

The best recipes on all subjects in the National Recipe Book. Post paid, $2.00. Michigan Publishing Company, Battle Creek, Mich.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

We will Remove and Prevent Scale in any Steam Boiler or make no Charge. Two Valuable Patents for Sale. Geo. W. Lord, Phila., Pa.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

For Hydraulic Jacks and Presses, New or Second Hand, send for circular to E. Lyon, 470 Grand Street, New York.

For Marble Floor Tile, address G. Barney, Swanton, Vt.

Old Furniture Factory for Sale. A. B., care Jones Scale Works, Binghamton, N. Y.

Steel Castings to pattern, strong and tough. Can be forged and tempered. Address Collins & Co., 212 Water Street, New York.

Portable Baths. Address Portable Bath Co., Sag Harbor, N. Y.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 23 Broadway, N. Y., or Box 1509.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $4. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Better than the Best—Davis' Patent Recording Steam Gauge Simple and Cheap. New York Steam Gauge Co., 46 Cortlandt St., N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For hand fire engines, address Rumsey & Co., Seneca Falls, N. Y.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 year.

18,000 Blows a Minute

Can easily be given with our new machine for reducing SEWING MACHINE NEEDLES.

It is universally acknowledged to be the best and most practicable machine ever invented for reducing metals; doing the work very much faster than any other machine, and it will run for years without any perceptible wear. Our machines are operated on an entirely new mechanical principle, discovered by Mr. Hendryx—a principle which produces the most perfect mechanical arrangement for a rapid motion ever yet invented; the dies can be made to strike twenty thousand positive blows a minute.

We are now prepared to furnish our machines at a reasonable price, to any or all parties who may want a very superior machine for reducing sewing machine needles, for pointing wire, for wire drawing, or for swaging any articles where a very rapid stroke is required.

Sewing machine needle makers will find it greatly to their advantage to call on us and see our machine in operation, as the introduction of our machine into the art of needle making will cause the plan of swaging needles to entirely supersede the old plan of milling, for it not only makes a great saving in the cost of making the needles, by greatly lessening the cost of reducing them, besides saving more than half of the wire used in making milled needles, but the process of swaging makes a needle which is far superior to a milled needle—for, in reducing needles by the milling process, all of the best of the wire, the outside, is cut off and wasted, the poorest part of the wire, the core, only being used; while the swaging process, by condensing the particles of metal, makes the part of the needle which is reduced far superior to the wire itself.

Our machine is fully covered by good valid patents in this and foreign countries. Communications by mail will receive prompt attention. Call on or address Webster & Hendryx, Ansonia, Conn.

Facts for the Ladies.—Mrs. J. Brewer, Stamford, Ct., bought her Wheeler & Wilson Lock-Stitch Machine in 1863; earning the first two years her rent and household expenses for self and child, and $710 in the savings bank; has six of the original dozen needles. See the new Improvements and Wood's Lock-Stitch Ripper.

The Queen of all Sewing Machines.—In speaking of the merits of the New Wilson Under-Feed Sewing Machine, it is sufficient for us to say that we think the invention of this machine marks one of the most important eras in the history of this country; and when we consider the influence it has upon the social well-being of the masses, it is difficult to conceive of an invention of more importance. It has a beautiful, noiseless movement; it makes the genuine "Lock-Stitch" alike on both sides, and does to perfection all kinds of plain and fine sewing; it needs no commendation; its rapid sales, the increasing demand, and the many flattering testimonials from those who have used it, is sufficient proof of its merits. The want of a sewing machine is deeply felt in every household, and as the Wilson Sewing Machine, on account of its extreme simplicity and less cost of manufacture, is sold at a much lower price than all other first-class machines, it is meeting with the extensive patronage that it so justly deserves. Salesroom, 707 Broadway, New York; also for sale in all other cities in the United States.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—HAIR DYE.—Will some one give a recipe for hair dye such as barbers use, that smells like bad eggs?—G. H. J.

2.—IVY.—What are the actual advantages or disadvantages of ivy growing on brick walls?—J. H. L.

3.—THE MAGNETIC POLE AND THE MERIDIAN.—In erecting a sun dial, I am obliged, for want of proper instruments, to use a compass or to observe the pole star to find the meridian. I am aware that the compass, except on the line of no variation, points to a spot some distance from the north pole (to the east, I believe.) Moreover, the pole star is not exactly over the north pole of our earth. Will some one tell me exactly how much the needle deviates, in this longitude (38° 30′ W. of Washington) from the true north, and how far the pole star is from the zenith of the north pole?—L. H.

4.—COMPOSITION FOR MATCHES.—Will some one inform me how to make a friction match composition which will not dissolve in damp weather, and will not be very expensive?—C. B.

5.—INCREASING THE POWER OF BOILERS.—I have a plain boiler 28 feet by 30 inches, driving an engine of which the cylinder is 6 inches by 30 inches. The boiler works at from 50 to 60 pounds on the square inch, and the engine at 50 revolutions a minute, and her fly wheel is 7 feet in diameter. I do not get power enough, and I think by increasing the size of the pulley on the main shaft, and running the engine at 65 or 70 revolutions, I can obtain the requisite work. But the boiler will not supply the necessary steam; and how can I make it generate more, or use what I now get to greater advantage? My feed water is heated by the exhaust steam till the feed pipe is too hot to hold in the hand. I have seen a device consisting of hollow grate bars, etc., but it is too expensive. Would it be safe to attach anything to the bottom of the boiler, or would an improved feed water heater answer?—J. S. P.

6.—THE EARTH'S ORBIT.—Is the distance of the sun from the earth greater in summer (say July) than in winter (say January) or not?—O. F.

7.—PURE VINEGAR.—One of your subscribers is very anxious to know about vinegar, whether we must eat eels that can be seen with the naked eye, or whether we can have good vinegar without the large animals. With a glass, I have found, in cider vinegar, large and lively eels; other specimens showed skeletons without life, and others, of good quality, a clear reddish liquor with a little sediment without skeletons or life. Can we have vinegar without eels?—J. E. H.

8.—STEEL QUERIES.—Is the fact, that a small blade of steel can be ground and brought to a perfect cutting edge, evidence that the quality of the steel is good? Also, is bar steel, as it is sold, hammered enough to stand well for making light dies, or does it require forging?—W. L. G.

9.—POWER FOR FAN.—Can any one tell me how heavy a weight it will take to run a fan (18 inches in diameter by 18 inches long, with 4 arms) one hour? The weight is to fall ten feet and the fan to run 150 revolutions per minute. What is the rule for the calculation?—A. D. L.

10.—MASS MOTION AND HEAT.—W. H. P., in answering I. E., query 18, page 385, last volume, gives the equivalent of force in units of heat. Will he or some one else say whether there are any mechanical or chemical means by which force can be converted to heat, or what the nearest approach in practice is to the theory? I have asked this same question in another shape last winter, when I was in Nebraska, where there was plenty of force and very cold weather, which forcibly impressed me with the need of such a converter.—I. L.

11.—TEMPERATURE IN ICE HOUSE.—My ice house is built above ground, of two pens of logs, the space (two feet) being filled in with old wet sawdust. It is floored and covered with dust. The temperature is 140° or 150°. My ice all melted. Some knowing ones say it should have been ventilated. Will you please inform me in your paper the cause of the high temperature, and was it want of ventilation that caused the ice to melt?—J. C. McC.

12.—SPONTANEOUS COMBUSTION.—One evening last week came in from the road (I am an engineer) and laid my overalls in the tender box; they were very greasy. The next morning I opened the box, and found the entire contents a mass of fire. My fireman was cleaning off the stack a day or two ago with a piece of waste saturated with linseed oil. After completing the job, he laid the waste in his tender box, and on opening it, in eight or ten hours after, he found it burnt out, the same as mine was. Were these cases of spontaneous combustion? I related the above circumstances to a professor in a college, and he said they were not cases of spontaneous combustion, as there were but four cases in the known world. If they were not caused from spontaneous combustion, what were they?—W. F. C. S.

13.—EXPANSION OF LOCOMOTIVE BOILER.—What is the use of the angle irons at the side of the fire box, which are slotted to allow the boiler to expand on the frame when the back braces, bolted to the boiler and frame have no slots, or other provision to allow the boiler to expand? Do not the braces or frame spring? If not, what does give, as the boiler certainly expands when fired up?—W. F. C. S.

14.—EXTINCTION OF CAB LAMP ON A LOCOMOTIVE.—What causes my cab light to go out when I blow the whistle?—W. F. C. S.

15.—NOISE OF A LOCOMOTIVE.—What causes the rumbling noise, which a person can hear for three or four miles and feel in every bone of his body, when I drop the front damper and pull up the back one, or when my engine is working hard on a grade?—W. F. C. S.

16.—SETTING BOILERS.—I am an engineer, and my boiler arch stands north and south. The boiler is 11 feet long with a 5 foot shell, 64 flues. My grate (Tupper) surface is 3½ feet wide and 5 feet long. From the door to the bridge wall is 6½ feet. My fire passes through the boiler, back over the top and enters the smoke stack, 50 feet high, built of brick. My fuel, shavings and sawdust principally, is pushed into the arch with the head of a rake, the arch door being on a level with the floor. The ash pit extends about the distance of a foot beyond the front plate of the arch, and the draft is taken through that aperture to the under side of the grate. In order to economize fuel, I fire very often, the average being 26 times an hour. I run mostly with closed damper. The damper in the chimney does not fit perfectly close, and the one in the draft plate in the front of the door is generally kept ajar by the dirt getting underneath it. My grate becomes in the morning a cherry red, and sometimes before the day closes becomes a white heat. I have terrific carbon explosions; they occur oftentimes in putting in a half bushel of fuel, and seldom when the dampers are shut. I have been recommended to keep up a sharp blaze in the rear of the arch as a kind of gas-burning fire, but it gives me no relief. These explosions usually take place about two minutes after the fuel is put in, and sometimes so powerfully as to raise the draft plate, which weighs 300 pounds. These explosions are more terrific when burning sawdust or matching chips than when burning surface shavings. I endeavor to keep my grates constantly covered, and therefore pack my fire closely as possible. Can any one tell me the cause of the explosions and the remedy? Is there a remedy other than letting more cold air strike the grate?—J. D. H.

17.—WOODEN RAILWAYS.—My attention has been called to an article in your issue of July 20 headed "Wooden Railways," and from your suggestions I am induced to believe that such railways would be best adapted to the short roads now in contemplation throughout this State. The great cost of iron railways has, in a measure, deterred individuals from embarking in such enterprises, and more especially does this apply to this portion of the State, which is just beginning to recover from the effects of the war. The citizens of this vicinity of our town, which is situated on the banks of the Mississippi, are canvassing the subject of building a railway to the Bayou Macon hills, at a point some 20 miles in the interior. The county through which this road would run is almost entirely uninhabited, owing to the annual overflow from the Mississippi. Previous to the war, when the levees were up, it was the largest cotton producing portion of our (Carroll) parish. As is usual on the Mississippi bottoms, the country is perfectly level, and little grading would be necessary. The country is thickly wooded, and the timber peculiarly adapted to any purposes requiring strength and durability. My object is to obtain all the information I can with reference to the cost of this wooden railway for the distance mentioned, the character of rails, cross ties, etc., as well as the cost and style of locomotives and cars best adapted to the same. Any suggestions your readers may make will be thankfully received.—C. M. P.

18.—EFFECTS OF FRICTION ON A RUNNING BELT.—In oiling a bearing, I have to put my arm through a belt. I often hear a snapping noise when I bring my oiler near the band, and when I take it away the noise would cease. (I used a copper oiler when I first noticed it.) I placed my ear close to the band and soon I felt a snapping sensation, as though something was pricking me. I placed my fingers close to the belt and there was a peculiar feeling like that of being pricked by nettles. I supposed it must be electricity, and I took some notice of it; when I held the nozzle of my oiler close to the band a fine stream, or shower, of oil would come out of it and fly to the belt. If I held it on the outside of the belt, it would go around into the inside of the belt before it would strike it. When I held the oiler between the belt, the oil would fly in a circle. The sound would be loudest after the machinery had been standing still for a space of time, and when it was coldest. A pricking sensation was distinctly felt, and oil would flow more freely from the oiler. I found a feeling, when I placed my face to the half of the band that came from the driver, different from the one felt when I placed it to the half that went to the driver. What makes the difference in the sensation? What makes the oil come out of the oiler, and why will it not fly on to the outside of the belt as well as on the inside? It was a leather belt four inches wide and about thirty feet long; and I notice it made some difference whether I used a tin oiler or a copper one, the copper one giving the best results, probably because it was a better conductor.—J. T.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

BENDING WROUGHT IRON PIPE.—J. V. R., of N. J., will find a successful method described on page 122 of Vol. XXVI. of the SCIENTIFIC AMERICAN.

HERMAPHRODITIC POULTRY.—I address you a few lines to ask a question regarding a chicken that is on my place. In 1871, it laid and hatched two broods of chickens; it commenced crowing in the fall; in the winter it was a little stupid; in the spring it assumed the form and performed the offices of a fully matured rooster. The above can be substantiated by good authority, or the chicken can be produced. I would like to hear from you through your valuable paper, as it is a freak in nature that I don't understand. Answer: We advise our correspondent to produce the chicken and arrange with Barnum for its public exhibition. A chicken matinee in this city would be a novelty and doubtless draw a crowd.

DRIVING POWER OF RUBBER BELT.—In your issue of July 27, page 58, the driving capacity of a two ply rubber belt is given as one horse power for every two inches in width, when the belt travels at the rate of 1,500 feet per minute. This, I think, is a low estimate; from my own observations I am satisfied that a two ply belt, running at the above speed, will drive double that amount of power without injury, or one horse power for every inch in width, and a three ply will do the same with every three quarters of an inch in width.—W. A. L. K.

SKIN DISEASES.—To C. N., query 7, page 41.—The trouble comes from your liver. Take podophyllin pills, one every evening for two weeks; if the bowels become too relaxed, omit an evening.—M. B. E., of Pa.

BLACK INK.—To M. W. H., query 2, page 58.—Take tannic acid, 20 grains, and a similar quantity of gallic acid; dissolve in 2 ounces water. Then take copperas crystals and Monsel's salt of iron, each 15 grains, and dissolve in 2 ounces water. Mix the two solutions and add 2½ drams of mucilage and 2 drops oil of cloves. This ink will cost one dollar a gallon.—H. J. H., of Mich.

INK.—Let M. W. H. (query 2, page 58) make a strong decoction of logwood, and add a little chromate of potash. No gum required.—E. H. H., of Mass.

DISSOLVING GUTTA PERCHA.—R. J. (query 7, page 58), should use bisulphide of carbon.—E. H. H., of Mass.

WATERPROOFING PAPER PULP.—To W. R. H. (query 10, page 58.—Try a larger proportion of resin than usual, and when the paper is dry, pass between hot rolls.—E. H. H., of Mass.

CRYSTAL GLASS.—To G. T. P., query 15, page 58.—The following mixture will give good results: Carbonate of potash, 112 parts; red lead, 224 parts; sand (washed and burnt), 336 parts; saltpeter, 14 to 28 parts; oxide of manganese, from one fourth to three fourths of a part. Mix thoroughly and melt together.—E. H. H., of Mass.

HARDENING OF RAIN WATER.—To B. D. A., query 16, page 58.—Your trouble arises from the water, dissolving the lime of the cement used in the cistern. If the cement be painted, so as to protect it from the solvent action of the water, you will no longer be annoyed by its hardness.—E. H. H., of Mass.

"A MISER OF TIME."—If the writer over the above signature, in your issue of July 27th, will try the ECLIPSE PAPER FILE, illustrated in No. 18, Vol. XXV. of the SCIENTIFIC AMERICAN, his complaint will be silenced.—A. S., of Ala.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

WHIFFLETREE DRAFT EYE.—Edward E. Tompkins, Sing Sing, N. Y.—This invention furnishes an improved draft eye for whiffletrees, which consists of a stem which is screwed into the end of the whiffletree, and which receives the eye of the tug. To the outer end of the stem is swiveled a cross head or button, upon the side of which is formed a toe or eccentric. The cross head is turned into line with the tug eye and the latter passed over it, when the pressure of the sides of the eye upon the eccentric forces it into one end of the eye, and thereby brings the cross head at right angles to its length; thus rendering it impossible for the tug to be accidentally detached, however much it may swing about.

PLOW.—Alexander Rickard, Schoharie, N. Y.—This invention has for its object to improve the construction of shovel plows, so as to make them more generally useful, and consists in providing the foot of the plow standard with an adjustable shoe which admits of being set so as to bear squarely upon the bottom of the furrow at whatever angle the plow may be working in the ground. The plow thus draws steadily instead of hopping along upon its point when adjusted to run deep in the ground. The shovel is made with adjustable wings, which are secured to the stationary wings by bolts which pass through slots in the former, so that they may be set out or in as desired. Upon the central upper part of the shovel is formed or attached a colter to divide the soil as the plow is drawn forward and make it work easier in hard ground.

WINDMILL.—Arent Geerlings, Holland, Mich.—This invention relates first, to a new arrangement of devices for adjusting the wings automatically to take the breeze more or less, according to its force, so as to maintain a uniform rate of speed; and, secondly, to a new construction of the wings themselves; the same being bent forward at their forward edges and rear outer corners so as to cause the wind to pass inward and be discharged at their rear inner corners.

BRAKE FOR LIGHT MACHINERY.—John M. Cayce, Franklin, Tenn.—This invention is more particularly applicable to sewing machines, where it is employed to regulate the speed of the needle. It consists of a cam attached to a sleeve which is placed on the shaft which drives the needle. The cam is operated upon by a spring lever which can be adjusted to have the required tension to a nicety. By means of the sleeve, the cam can be adjusted to operate in any part of the revolution, and thus retard or not the movement of the needle, as desired.

TOY SCROLL SAWING MACHINE.—Samuel N. Trump, Rossville, Md.—The invention consists in holding the lumber with clamps while it is fed against the saw which then cuts in a straight or curved line.

PUMP.—Wilson Barnes, Maquoketa, Iowa.—This invention consists mainly in a pump whose hollow parts are made of wrought iron galvanized tubing, the sections being connected together by internally threaded couplings.

SHOE FASTENING.—Chas. E. Chinnock, New York city, and Christian G. Schneider, Washington, D. C.—The invention consists in an arc-shaped loop and extension applied to fasten and then hold the shoe securely buttoned.

SELF REGULATING FEED AND TELLTALE FOR MILL BURRS.—John D. Mines, Moffatt's Creek, Va.—The invention consists in feeding grain into the eye of a mill burr runner through a reciprocating tube, cup, and vibratory funnel, in causing the vibratory funnel to operate the feed tube, and in providing the grain supply spout with a flexible valve attached to a lever operated from the discharge funnel, so as to ring a bell when the flow of grain ceases.

BRICK MACHINE.—Daniel Hess, Des Moines, Iowa.—The invention consists chiefly in the employment of a yielding or self adjusting upper inclined plane or track, for operating the upper series of pressing devices whereby injury or breakage of the surrounding parts is prevented if the molds are too densely packed or contain a foreign substance, as the inclined plane will in such an event rise and allow of the passage of the pressing devices without injury and be immediately returned to its normal position by the action of a weighted lever connected with the same.

COUPLING.—James Higgins, Montague, Mich.—The invention consists in a metallic coupling, formed of two reversely crooked hooks, and a sleeve which is tapered in the direction of the shanks of the hooks. The coupling is intended for use with the standing rigging of small vessels and in attaching wooden traces or shrouds without nails, rivets, or screws.

SIDE SADDLE TREE.—Dudley M. Oliver, of Charleston, Ill.—The object of this invention is to improve the construction of side saddles, and it consists in a new arrangement of the pad bar and horn, whereby a shoulder is left in front of the horn, to which a leather spring is nailed. The seat is rabbeted so as to receive the straining piece. The tree is made of wood and covered as usual, and is stayed by strips of metal.

COCOA NUT GRATER.—William H. McCall, of Philadelphia, Pa.—This invention furnishes an improved machine for grating cocoa nuts, which consists in a cylindrical grater revolved within a box. The nut is placed in a hopper at the top so as to rest on the grater, and at the bottom of the box is a drawer to receive the grated nut.

COMBINED BUGGY POLE AND SHAFTS.—Gottlieb Stiener, of Deedsville, Ind.—This invention relates to combined thill and pole attachments for vehicles, of which some have already been patented, and consists in a new mode of combining the shafts or thills and double tree so as to form a very strong pole of the shafts when connected together.

MACHINE FOR CORRUGATING METAL.—John Moffet, of New York city.—This invention consists of a set of preparatory dies and a set of finishing dies for making square corrugations; the corrugations are formed by a preparatory operation, in which a set of oval dies form an oval groove in the iron about as deep as the finished groove is to be, and then the groove is completed by an operation of the finishing dies. When the final action upon the corrugation takes place, the finished shape is firmly retained, so that the subsequent action of the preparatory die does not draw the stock back and disfigure the completed corrugation as when a single set of dies is used to make the corrugation at one operation.

MOP HOLDER.—George Filedner, Portland, Oregon.—This invention relates to a new mop holder that can be opened by a quarter turn of the compressing nut and closed by a similar movement of the same: the sponge or rag mop is therefore easily removed, for wringing or washing, and replaced. It consists in the arrangement of an elongated compressing nut, in connection with a slotted or forked lower jaw of the mop head, in such manner that when the nut is crosswise under the jaw it holds it closed, but allows it to be freely opened when turned in line with the slot or opening of the jaw.

GRAPPLING FORK.—Gaspar Hunziker, Summit, Miss.—This invention consists of the peculiar construction and arrangements of the parts comprising a cage for grappling a pile of wood or coal in a frame or holder on the ground, holding it while being hoisted and swung over a tender or other vehicle to be loaded, and then discharging it by the opening of the jaws of the grapple by the gravity of the load when the holding devices for the jaws have been tripped.

SAWING MACHINE.—Joseph Smith, Woodburn, Oregon.—This invention consists of a table for a cut-off saw which is suspended on pivots above the saw, and of a latch for holding the table in advance of the same while receiving the log or plank to be sawn; they are arranged in such manner that, when the latch is tripped, the gravity of the table and its load feeds the work to the saw.

WATER WHEEL.—Orlando D. Wetmore, Claremont, N. H.—This invention furnishes an improved water wheel which is more readily controlled than wheels constructed in the ordinary manner; it consists more particularly in providing a movable chute which is arranged to be w rked, watertight, between a fixed chute and the wheel, in such a manner as to serve as a gate for regulating or preventing the ingress of the water.

COMBINATION RIFLE.—Marshall Wood, Lewisburg, W.Va.—The invention consists in combining a toggle for reciprocating the breech bolt with a hand operating mechanism; in combining a series of cartridge carriers with the several guns so that they will feed all the guns simultaneously, in a peculiar construction of cartridge carriage with a zigzag chamber, so as to feed by a vibratory movement, in attaching to the carrier a sweep which discharges the spent cartridge in advance of the feed, and in operating a series of connected cartridge carriers by means of rods and cam-slotted levers.

COMBINED LIFTING JACK AND DERRICK.—The invention consists in forming a jack with a movable fulcrum, a spring that either retracts or presses forward the detent, and a pawl presser that forces the pawl into and holds it to rack while the lever is taking a new position to let down weights. It consists also in combining a jack with a derrick so that it may be braced in any position. Hiram Senseman and Washington F. Pagett, both of Tremont, Ohio, are the inventors of this improvement.

MICA WINDOW FOR STOVES.—Stephen Foote, of Jersey City, N. J.—This invention relates to a new and useful improvement in the mode of adjusting the mica windows of stoves. The mica is secured by wires which are cast in the frame and bent down on to the mica. These wires form stops, which preven. it fitting closely to the stove plate, thereby leaving an opening equal to the diameter of the wires. By thus allowing a thin current of air to pass between the mica and the stove, the mica is preserved bright and undimmed for any length of time, while windows attached in the ordinary manner soon become dimmed by the smoke and gases from the coal.

CONFLUENT COCK FOR FILLING SODA BOTTLES.—Charles G. Ferron, of New York city.—This invention furnishes an improved cock for soda bottling machines, which is so constructed as to discharge the soda and sirup at the same time through the same pipe, and which may be adjusted to admit exactly the required amount of sirup each time.

FOLDING BOAT.—John Hegeman, of Vischer's Ferry, N. Y.—This invention consists in improving the construction of the pontoon boat, patented by the present inventor April 23, 1867, so as to make it more convenient in use, and more reliable and serviceable in operation; the improvement consists in the use of certain stay or fastening devices with the hinged parts or sections of the boat, which are so constructed that they can be turned out of the way so as not to obstruct the folding of the boat and yet are always in place ready for use.

MACHINE FOR POINTING THE EXTREMITIES OF HORSESHOE NAILS.—Harry A. Wills, of Vergennes, assignor to Julia A. Wills, of same place, and Lucy S. Kingsland, of Burlington, Vt.—This invention relates to machinery for manufacturing horseshoe nails, and in improvements in a machine for shearing or tapering the point of the nail, many features of which are already secured to the present inventor by letters patent. It consists in a sliding finger for filling the die, so as to form a smooth and level surface for the nail to slide on when it is pushed over the die for clipping; the finger being withdrawn when the nail reaches its position.

CLOTHES WRINGER.—Micheal Mallon, of Rahway, N. J.—This invention relates to that class of clothes wringers which are arranged to twist the clothes in the manner of wringing them by hand, the clothes being attached at one end to a holder, and at the other to the end of a shaft with a hand crank for turning it; it consists of a novel construction of the case or frame of the wringer, which adapts it for being readily and firmly attached to the wash tub, and insures the escape of the water back into the tub. It also consists of a novel arrangement of the holder, to which the clothes are attached, and the apparatus for adjusting it for clothes of different lengths; and of an arrangement for holding the clothes, after being twisted, to let the water drip off.

CHILDREN'S CARRIAGE.—Daniel Troxell, of Newark, N. J.—This invention relates to an attachment to children's carriages or perambulators, whereby the same are prevented moving unless actually handled by the attendant, all possibility of accidents by the rolling of the carriages down hill or into gutters during the momentary absence or inattention of the persons having them in charge being thereby avoided. It consists in the use of spring pawls or arms which bear against projec ing ears of the wheel hubs and are, by strings or rods, connected with the handle; so that when, together with the handle, such strings or rods are grasped, the pawls or arms are drawn up clear of the ears on the hubs; but, whenever the handle is released, the pawls or arms fall into the way of the ears on the hubs and prevent the rotation of the wheels.

VAPOR BURNER.—Charles Royle, of Brooklyn, N. Y.—This invention relates to burners employed for the combustion of hydrocarbon vapors. The feed pipe is placed at the side of the body of an upright burner, and its internal orifice is formed in a valve seat within the same. A screw passes through a screw hole in the lower end of the body and has a conical valve formed upon its forward end which fits into the valve seat, so that by turning the screw upward the valve is entirely closed, and by turning it less or more downward, less or more of the hydrocarbon is admitted to the burner. Upon this screw, at the lower end of the body, is placed or formed a collar and just below the collar is placed a packing of rubber, leather, or other suitable material. A cap is screwed upon the lower end of the burner which encloses the collar and packing and has a hole in it for the passage of the end of the screw. By this construction, the packing is forced down closely against the cap by the collar when the screw is turned down, and prevents any of the hydrocarbon finding its way out around the thread of the screw and dropping from the lower end of the burner.

PRUNING SAW.—Aaron Travis, of Peekskill, N. Y.—This invention furnishes an improved pruning saw which is attached to a long handle in an inclined position, so that when the handle is pulled the saw is drawn across the limb in proper position for sawing. The base or inner end of the saw plate is made inclined, and its rear corner projects in the rear of the handle and serves as a hook for drawing the limbs out of the trees after they have been sawn off. In the rear edge of the saw plate is formed a notch, the straight shoulder of which is sharpened and serves as a chisel for cutting off small limbs.

SHUTTLE FOR SEWING MACHINE.—Moses Cook and Moses G. Cook, of Ashfield, Mass.—In this invention, a retaining plate is hinged in and at one end of the shuttle. This is provided with a longitudinal rod which has a side spring. The thread from the spool is first passed under the spring, then coiled around the rod and finally carried out through a hole in the side of the shuttle at some little distance from the spring. By passing around the spring previously to being coiled on the rod, the several coils are prevented from crowding on one another and causing the thread to bind.

PLOW.—Francis Poindexter, of Franklin, N. C.—This invention furnishes an improved reversible plow which is simple, convenient, and effective; it is so constructed that it may be readily adjusted for use as a reversible or hillside plow, as a turn and subsoil plow, or as a single turn or cultivating plow, as may be desired.

THREE HORSE EQUALIZER.—Edmond K. Parish, of Shelbyville, Ind.—This invention furnishes an improved three horse equalizer, which is so constructed as to enable the draft to be distributed according to the strength of the horses; at the same time it may be so adjusted that the single horse may walk in the furrow, and the team upon the unplowed land, while each horse draws his proper proportion, and the plow takes the proper amount of land. It consists of two cross bars which are pivoted to the plow beam and connected together by the draft chains and rods, to which are attached the whiffletrees. All the parts and all their connections are adjustable.

FLUID PRESSURE REGULATOR.—William J. Fay and Thomas A. Cairns, of Denver, Colorado Territory.—This invention consists of a hollow cylinder attached to a globe or other like valve and communicating at one end with the chamber or pipe into which the water flows through the valve; in this cylinder is a piston, whose rod is connected to the valve; a coiled spring is placed behind the piston under such tension as to hold the valve open until the pressure becomes too great for the pipes beyond it, when the water pressure on the piston closes the valve and keeps it closed until the pressure on the piston and in the pipes to be protected falls below the power of the spring, which then opens the valve again.

COMBINED SLOP PAIL AND COMMODE.—David Patterson, of New York city.—The object of this invention is to furnish a cheap and convenient article for the household, which can be used as an ordinary slop pail or as a commode; it consists in constructing a slop pail with a movable seat, and with an annular space to receive water at the top. Into this space a flange attached to the cover, when open, projects, and thereby confines the odor.

STEAM GOVERNOR.—Anders Matson, of Quincy, Ill.—This invention relates to a useful improvement in governors for steam engines, and consists in so constructing the parts as to give facilities for the ready lubrication of the steam valve and working parts, and for the admission of oil into the steam chest and cylinder of the engine. A spring, also, is arranged to receive the concussion when the balls of the governor drop suddenly.

NEW BOOKS AND PUBLICATIONS.

THE WORKSHOP. Published by E. Steiger, 22 & 24 Frankfort Street, New York. Subscription $4.50.

The number for August presents an elegantly illustrated paper on the "Lion as an Art Subject," and furnishes its usual supply of exquisite designs, both in decorations and furniture, from the pencils of the first European artists.

THE ATLANTIC MONTHLY. Boston: James R. Osgood & Co., Publishers. $4.00 a year.

In its August number, this Monthly continues Hawthorne's pleasing novel; John A. Bolles tells why "Semmes was not Tried;" James Parton contributes a paper on "Jefferson;" and Dr. O. W. Holmes gives another instalment of his fascinating "Poet at the Breakfast Table." Altogether, the number is remarkably entertaining and brilliant.

LIPPINCOTT'S MAGAZINE. J. B. Lippincott & Co., Publishers, 715 & 717 Market Street, Philadelphia, Pa. $4.00 a year.

The number for August is unusually attractive. There are two illustrated papers—"A Switchback Excursion," and "Travels in the Air"—the latter furnishing some curious and valuable facts in aeronautics.

THE AMERICAN SYSTEM. Speeches on the Tariff Question, and on Internal Improvements, principally delivered in the House of Representatives of the United States. By Andrew Stewart, late M. C. from Pennsylvania. With a portrait. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

This is a collection of speeches made by Mr. Stewart upon the above subjects, and in advocacy of what was called by Mr. Clay "the American System." It contains over 400 pages, and is fully indexed for reference. Free by mail to any part of the United States for $3.00.

We have also received, from the same publisher, the following:

GALVANOPLASTIC MANIPULATIONS. A Practical Guide for the Gold and Silver Electroplater and the Galvanoplastic Operator, with one hundred and twenty-seven Figures in the Text. Translated from the French of Alfred Roseleur, Chemist, by A. A. Fesquet, Chemist and Engineer. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

The nature of this work is sufficiently indicated by its title. It is a handsome volume of 500 pages, in which the subject appears to be very fully treated. It is copiously indexed. Price, free by mail, $6.00.

THE SCHOOL OF CHEMICAL MANURES; or, Elementary Principles in the Use of Fertilizing Agents. From the French of M. George Ville, by A. A. Fesquet, Chemist and Engineer. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

This little book is a *resume* of several larger works by the same author. It is intended for popular use, and is written in a familiar dialogue form. Price, by mail, $1.25.

TABLES AND DIAGRAMS RELATING TO NON-CONDENSING ENGINES AND BOILERS. W. P. Trowbridge. New York: John Wiley & Son, 15 Astor Place.

In this work are given the results of a great many experiments and calculations, in the form of tables, showing the power, etc., of non-condensing stationary steam engines and boilers of various dimensions, speeds, and pressures. They are particularly calculated to aid the manufacturer or purchaser in choosing a form of engine and boiler suitable for any special purpose required, ranging from 5 to 300 horse power. The subjects of boiler explosions, the safety valve and other matters, are also treated of. Price, by mail, $2.50.

NEW PATENT LAW IN CANADA.

By the terms of the new patent law of Canada (taking effect September 1st 1872) patents are to be granted in Canada to American citizens on the most favorable terms.

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In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with Munn & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish pamphlets of instruction free.

Messrs. Munn & Co., have had twenty-five years experience in the business of obtaining American and Foreign Patents for inventors; they have special agencies in nearly all countries where patents are granted. Moderate charges and prompt attention may always be expected.

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Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letter Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Addres MUNN & Co., 37 Park Row, New York.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co 37 Park Row, for full particulars.

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Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

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MUNN & Co. have solicited a larger number of European Patents than any other agency. They have agents located at London, Paris, Brussels Berlin, and other chief cities. A pamphlet, pertaining to foreign patents and the cost of procuring patents in all countries, sent free.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations opinions and advice, *no charge is made*. Write plain do not use pencil, nor pale ink: be brief.

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In all matters pertaining to patents, such as conducting interferences procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice,

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DESIGNS PATENTED.

5,986 to 5,988.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,989.—CARPET.—J. M. Christie, Brooklyn, N. Y.
5,990.—SASH LIFT.—O. F. Fogelstrand, Kensington, Conn.
5,991.—BIRD CAGE HOOK.—O. F. Fogelstrand, Kensington, Conn.
5,992.—DOOR BUTTON.—O. F. Fogelstrand, Kensington, Conn.
5,993.—CUPBOARD BOLT.—O. F. Fogelstrand, Kensington, Conn.
5,994.—CAMPAIGN MEDAL.—W. B. Gregory, La Fayette, Ind.
5,995.—SHOE.—A. H. Herring, Haverhill, Mass.
5,996.—SHAWL.—C. H. Landenberger, Philadelphia, Pa.
5,997.—BOOT HEEL PLATE.—C. Saunders, Philadelphia, Pa.
5,998.—CIGAR HOLDER.—O. F. Balston, Lake Mahopac, N. Y.
5,999 and 6,000.—CENTER PIECES.—S. Kellett, San Francisco, Cal.
6,001.—CAMPAIGN BADGE.—G. C. Thomas, Brooklyn, N. Y.

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918.—MEDICINE.—I. S. Johnson & Co., Bangor, Me.
919.—MUSTARD.—Swain, Earle & Co., Boston, Mass.
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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

21,782.—ROTARY PLANING CUTTER.—J. Sperry. Sept. 25, 1872.
21,829.—PHOTOGRAPHIC SHIELD.—E. Gordon. Oct. 2, 1872.
21,977.—REFRIGERATOR.—B. M. Nyce. Oct. 16, 1872.
21,924.—PATCHING BULLETS.—L. H. Gibbs. Oct. 9, 1872.
22,028.—SHEET METAL SHEARS.—D. Newton, Oct. 23, 1872.
22,100.—BRAIDING MACHINE.—A. B. Clemons. Oct. 30, 1872.

EXTENSIONS GRANTED.

21,029.—CLOTHES WRINGER.—I. A. Sergeant. (In two parts.)
21,080.—QUARTZ CRUSHING MACHINE.—C. P. Stanford.
21,036.—GRAIN SEPARATOR.—B. T. Trimmer.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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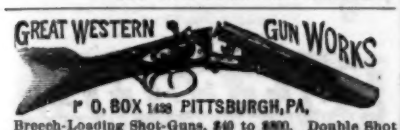

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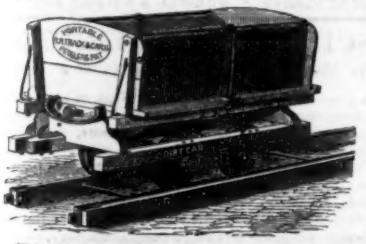

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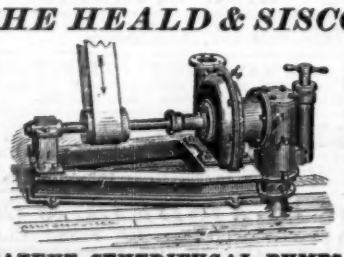

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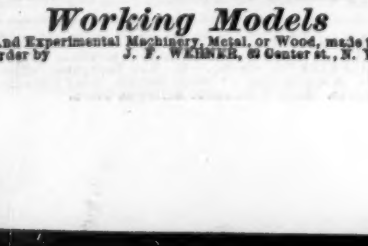

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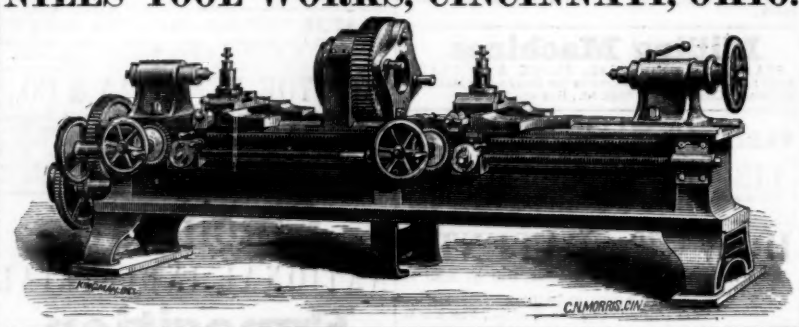

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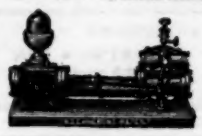

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